POPULAR WIRELESS, April 7th, 1934. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

TEN THOUSAND LETTERS!—By Val Gielgud

WHITHER TELEVISION?

Popular Wireless

No. 618. Vol. XXV. April 7th, 1934.

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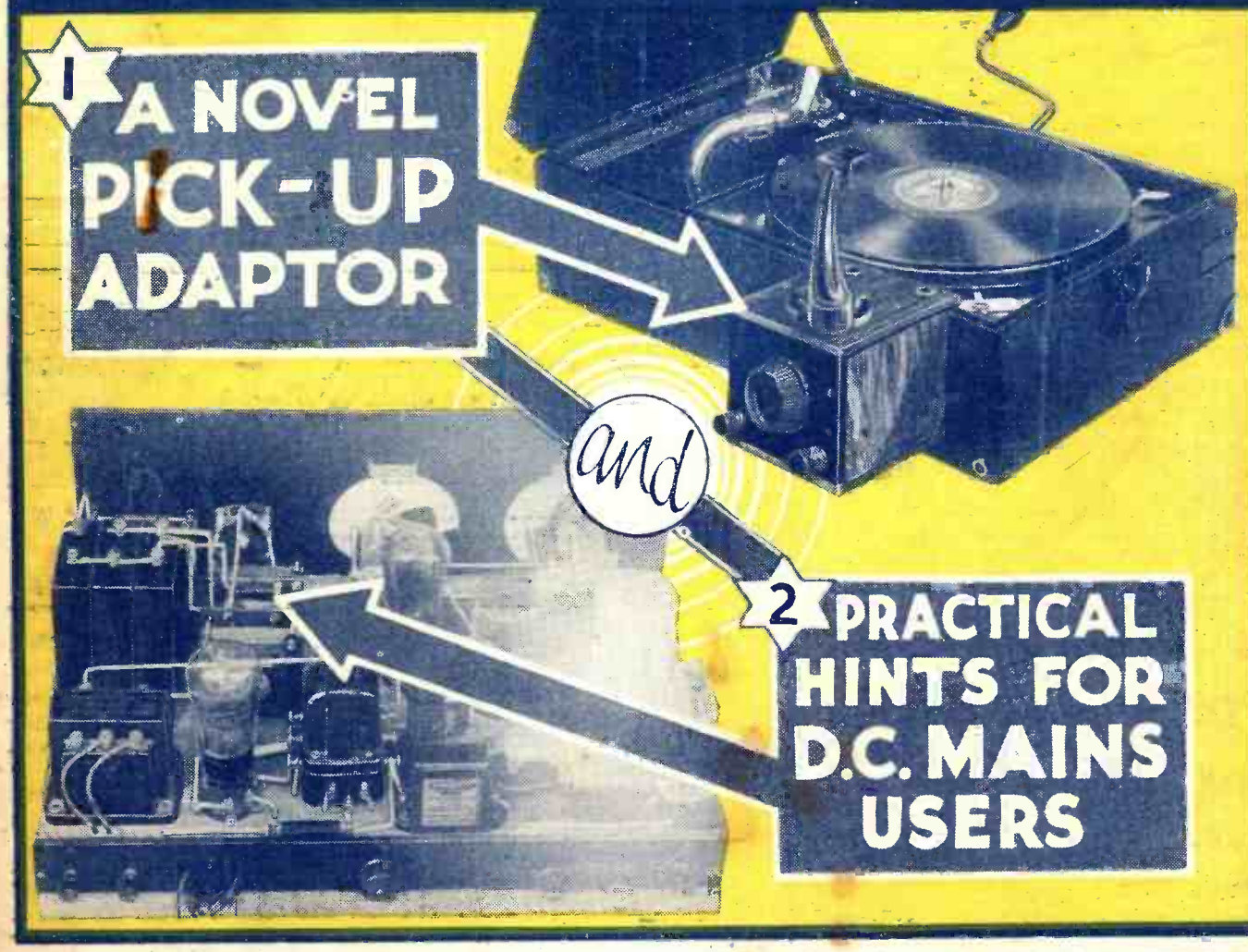

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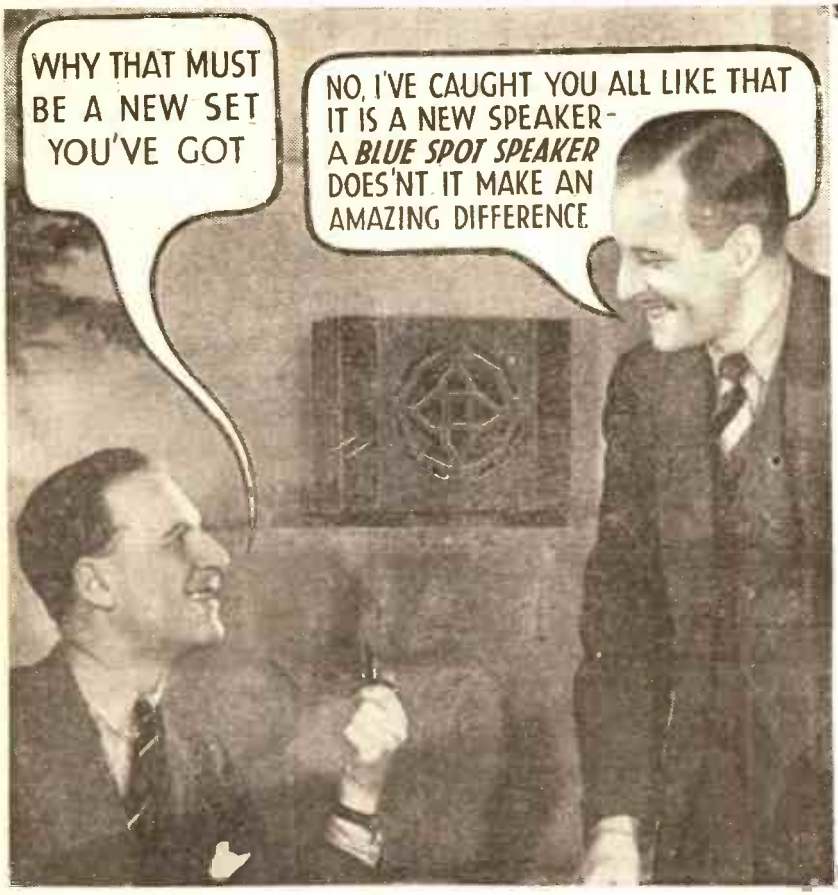
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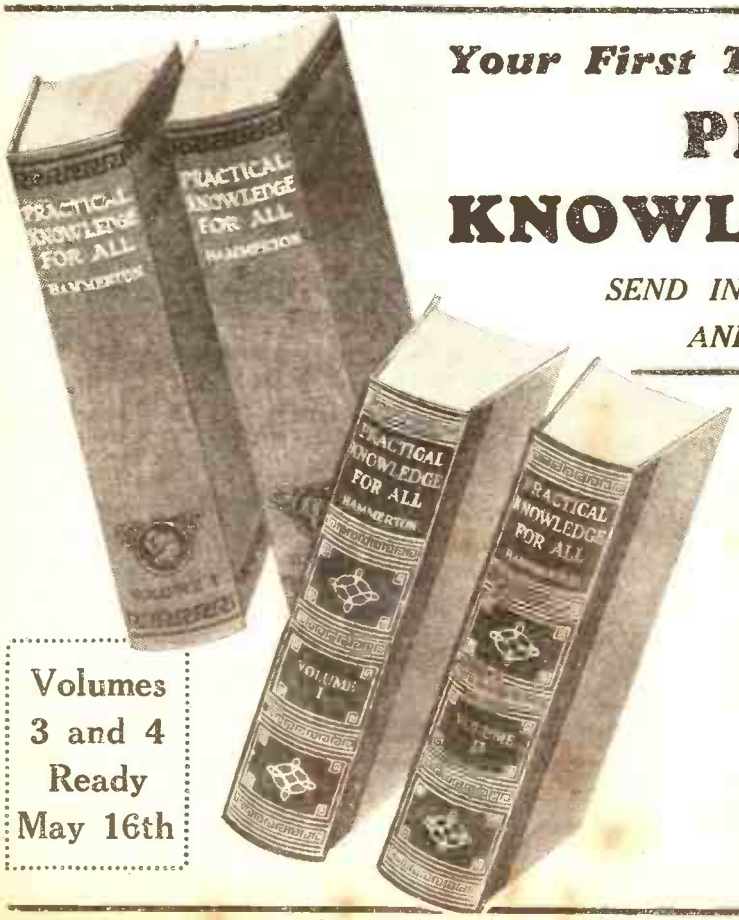

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POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: G. V. DOWDING, Associate I.E.E.
Assistant Editor: P. ROBERT BIRD.
Managing Editor: N. F. EDWARDS.
Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A JOHNSON-RANDALL.
Chief of Research: K. D. ROGERS.

THE TRADE OUTLOOK.
BELGRADE'S HUSTLE.
HAUNTED HOUSES
SHORT MEASURE

RADIO NOTES & NEWS

PIPES AND PIPING
HUMMING WIRES
A MONSTROUS STORY
MYSTERY RAYS

1,000,000 a Year.

HERE'S a bit of really bright news for a start this week. "The Wireless and Gramophone Trader," which has been taking a census of the radio industry, announces that a million British sets, value some 14 million pounds, were sold last year.

ON OTHER PAGES:

". . . . Practically all the new revenue accruing to the B.B.C. will be spent on programmes . . . ." **Page 84**

". . . . This is the first time in broadcasting history that the proposal I am about to make has been seriously put forward . . . ." **Page 87**

". . . . A prominent American manufacturer is in a position to supply seven-metre television sets complete for the price of a mains receiver . . . ." **Page 80**

Congratulations to the industry on a record of which they can be proud.

With a million sets in a year, and getting on for 6¼ million licences, we may hear a little less about "saturation."

More Jobs for Radio Workers.

IS it not pleasing to know that one of the oldest radio firms in this country, Burndept Ltd., is establishing a new factory which will provide work for about 1,000 people?

The factory, which is at Erith, Kent, and which was formerly a gunworks, has a floor space of 104,000 square feet, and the office and garage belonging to the place have floor space of 21,000 feet. They are going to make dry batteries there, amongst other things.

A Moving Story.

THE British makers of the Belgrade broadcasting station inform me that it was decided to move the station from the centre of the city to Makis, a place 10 kilometres out in the country. On Friday, February 23rd, the programmes ended at midnight, and the engineers then began the work of dismantling. By 9 p.m. on the following Wednesday the station was re-erected and working! Who says that Europeans cannot hustle?

Criticism Can Run Riot.

IN their anxiety to find ammunition for the lapidation of the B.B.C. some of the critics have recently been brought to dire straits, for they have been reduced to reproducing alleged complaints by the staff about the alleged hard discipline, petty tyrannies and quarter-deck methods of Broadcasting House—in a word, they have produced the Grand Red Herring.

Personally I doubt whether the internal organisation of the B.B.C. is any more the concern of the public than is that of the Port of London Authority or the South Metropolitan Gas Company, and I deprecate any attempt to link it up with the question of the programmes.

Ghosts Unlimited.

AS a result of his radio talk on "Ghosts and Haunted Houses," Sir E. Bennett, M.P., has received many hundreds of "genuine ghost stories." A very sad illustration of the gullibility and superstition of the public (says Ariel).

The only genuine ghost is the B.B.C.'s "ghost in goloshes"—and even that one has been laid.

However, perhaps Sir E. Bennett will give us a reading from his letters, or, better still, get Bransby Williams to do so next Christmas.

Television Demonstrations.

THE Uxbridge District Branch of the Anglo-American Radio and Television Society informs me that it proposes to give television demonstrations on most Wednesdays, and that everybody is welcome, without charge.

They have been having very successful evenings recently, as I reported some weeks back; but the prize instance of enthusiasm goes to the "fan" who push-biked from Ealing just to *see* the set. He had no time to see the demonstration!

For details, write to Mr. L. W. Orton, "Kingsthorpe," Willowbank, Uxbridge, Surrey.

Watch for the Marks.

AS a result of a Board of Trade inquiry an Order has been made prohibiting the sale, or exposure for sale, unless bearing an indication of origin, of (*a*) thermionic valves dissipating a dead loss at the anode not exceeding 50 watts; and (*b*) rectifying valves not exceeding a capacity of 60 V.A. or passing a current of more than 1 ampere.

The indication of origin must be marked in a contrasting colour on the bulb or cap of each valve, and also printed or stamped on the carton or other container.

A Personal Note.

DR. A. F. PHILIPS, joint founder of Philips Lamps, Ltd., in 1894, was 60 years old on March 14th.

When his firm began it had 42 employees, to-day, all over the world, it has 40,000, and Dr. Philips has controlled the whole business himself since 1922. Nevertheless, he is, like most busy men, able to find time for lots of things outside his main job, such as golf, horsemanship, motoring, art collecting and winter sports.

He has thirteen foreign decorations—such an unlucky number that I hope that someone will at once give him another.

ON THE AIR THIS WEEK:

Geraldo and his Orchestra *(Wednesday, April 4th.—National.)*

English to the core, despite a foreign-sounding name and an aptitude for continental music. Rehearses four hours every morning and conducts his band at engagements for the rest of the day. Decided in 1930 to form a permanent tango band in this country. "We like it," said the Savoy Hotel; "come and play for us." Spare-time hobbies? He has no spare-time. Fifty stage appearances a week, broadcasting and hotel work haven't left much time for tiddlywinks.

Royalty-Free Records.

AS the natural result of the breakdown in the negotiations between the Cinema Exhibitors' Association and the gramophone record-making companies, the

(Continued on next page.)

LOCATING SEA-SERPENTS BY RADIO

C.E.A. has made arrangements with an old-established music house for the production of non-combine, royalty-free records.

The performance of such records in public will, however, require the licence of the Performing Right Society, if they are works covered by that society.

These records will cost 3s. each, but the requirements of the cinemas are to be satisfied first.

Ariel Gives Short Measure.

TWO beer experts, one from the B.B.C. and another, R. C., of Rugby, tell me that my reference to the old-time members of the Huddersfield Choral Society as being allowed three gills, or *three-quarters of a pint*, of beer is incorrect, because the North Country gill is equivalent to a Southern half-pint.

Oh, generous Northerners! I congratulate you.

R. C. jumps rather heavily upon me, attributing my ignorance to my Cockneyship. But I am Kentish to the ultimate electron, and no Northerner can bite his thumb at Men of Kent. However, this is a side issue. To our muttons!

A Minor Tragedy.

A MAN I know, not very well to do, had long dreamed of possessing a radio-gramophone. Then, one fine day, his wife had a windfall—a "sweep" prize or matured insurance policy or such-like—and, like a nice girl, decided to share the loot and give her man his radiogram.

So eventually he came home to find the thing all set and ready, with wifie in the background sizzling with excitement. Well, he is a sport and a good actor, and so all went well. But, do you know, he told me that everything about that instrument is exactly opposite to what he longed for?—colour, design, control and so forth.

And there he is, *stuck with it*, for, according to the man-and-wife game, there never was such a marvellous and charming set!

Pipes, Pipers and Piping.

PIPE-MAJOR WILLIAM ROSS, who was in the programmes recently, learned to play the bagpipes from his father and mother. He piped at, as well as fighting in the orthodox way, the Boers in the South African War, and we won.

He repeated this double-barrelled volleying in the Great War, and we won again. He is now instructor in the school of army pipers, Edinburgh Castle.

For four successive years he held the title of all-round Piper of Scotland, and was seven times winner of the Championship Gold Clasp at Inverness and eight times winner of the Lochaber Gold Medal. Man! what a pair of bellows!

By the way, the pipes come into our military history quite a lot—Indian Mutiny, Dargai, Loos, etc.

Telegraph Wires Again.

SOME time ago we had an interesting discussion in these Notes on the subject of the causes of humming by telegraph wires, but we did not clear up the problem conclusively.

Now W. C. L. (Egypt) calls my attention to the following passage from a book entitled "Airsense," by W. O. Manning: "This noise is due entirely to a large number of vortices which are formed by the wire, and which wander off down-wind in exactly the same way as those produced by a stake in a brook wander off down-stream."

But *Is* There a Wind?

THE author is writing of wires *in a wind*, however. Our problem was to account for the steady, strong hum on a calm day.

He continues: "But they are much more frequent, and, in fact, if one knew the precise musical note given off by the wire and the number of beats per second that this note represented, this number of beats would be equal to the number of vortices given off per second."

The whole thing now resolves itself into the question whether even on the stillest days there is enough wind at the wire's height to account for the hum.

Twenty-four Hours a Day.

I DO not entertain much hope that the 24-hour system will be officially imposed upon this country before the metric system is introduced. Look how long it took us to swallow "daylight saving"!

But I should like to point out that many thousands of us, soldiers who served on the Continent and wireless people both professional and amateur, are fully conversant with the 24-hour method of stating the time—if that is any help to the unfortunate authorities who have to decide the question.

Distinction for a Scout.

ALTHOUGH Paul Siple is not the first boy scout to accompany an antarctic expedition—for that honour fell, I believe, to our own Scout Marr, who was with Shackleton years ago—he is probably the first to broadcast from the antarctic.

In a speech from the expedition's base recently he said that at least twenty-five of his colleagues had been scouts. He was rebroadcast over the vast Columbia network in the U.S.A.—a great occasion for scouts and radio fans.

Did you hear him, and, if so, what were your impressions, please?

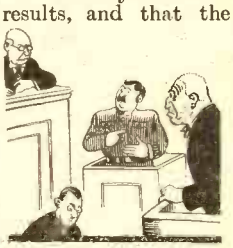
The Radio Squad.

FIRST, the Flying Squad; then the dress-suit brigade and now the Radio Squad! For Lord Trenchard, who cannot be accused of not doing things, is setting about the job of building the livest (apologies to the Oxford Dic.) corps of police radio men in creation.

Recruited from the existing ranks, these future terrors to the underworld are to be trained under a late lieutenant-commander, R.N. After this ordeal they are to be drafted into the Flying Squad, and then—heigh-ho for ker-rime and kilocycles.

Police Wireless.

THE Chief Constable of Brighton declares that the use of pocket radio sets by his boys in blue has had satisfactory results, and that the experience gained indicates a wider sphere of utility for police wireless.



Gloomy news, indeed, for the chevaliers of fortune, who will not now feel safe even in Lewes or on Firle Beacon.

What a pity, however, that we have no details of the coppers' log-books, for I understand that they have done some pretty DX reception. All except one unfortunate man whose position on point duty is such that he is "screened" by the pier.

New A.-A.R and T. Branch.

THE Anglo-American Radio and Television Society are attempting to form a branch at Heckington, South Lincs. It is proposed to hold meetings regularly and to organise from time to time tours of wireless stations. Full particulars can be obtained from Mr. J. W. P. Richards, The Vicarage, Heckington, Lincs., though inquirers are requested to enclose a stamped and addressed envelope.

A Monstrous Story.

UNLESS my ears deceived me, the B.B.C. announcer who read the item about the "monster" which was seen from the Mauretania during a West Indian cruise said: "The officers focused their binoculars on it and the wireless operator brought his direction finder into action"—or words meaning that.

Well, we can now locate herrings by radio, but the identification of sea-serpents by D.F. is quite a new one on me. Wireless operators are a sober race, especially when on duty, and one supposes that the skipper knew where the ship was at the time, so that the only explanation is that the operator wanted to ascertain their bearing from Loch Ness!

Will the B.B.C. kindly confirm this?

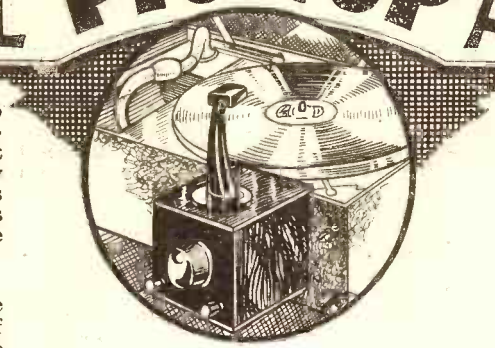
And Yet More Rays.

I HAVE made contact with a story about some newly discovered rays which are capable of producing fatal diseases, such as anthrax. As the heroes of the piece are said to be British I propose to make some inquiries in the proper quarters before I disclose the details of this matter.

I don't like the look of the story, especially in regard to some of the technical details, which seem to have a transatlantic flavour known as near-truth. Watch these columns for more.

ARIEL.

A NOVEL PICK-UP ADAPTOR



Owners of portable gramophones who wish to change over to electrical reproduction are faced with the fact that gramophones of this type do not readily lend themselves to the conversion. This is largely because space considerations do not permit accurate tracking of the pick-up to be achieved.

This week we describe a simple and efficient adaptor which provides a ready means of converting any portable gramophone for use with a pick-up. A particularly attractive feature of the unit is that it can be instantly detached should the owner wish to use his gramophone as an acoustic instrument.

By A. J. POTTS.

THE owner of a portable gramophone often wants to use the motor part of it in connection with a pick-up for electrical reproduction. So out he goes to purchase a pick-up. Having got one to suit his pocket and requirements, he returns home in triumph.

Then his troubles begin. A template is often supplied with the pick-up to enable proper tracking to be attained, but he finds he cannot put the pick-up on the motor-board to get proper tracking!

Always the arm is too long and the motor-board is too small. The unit I am about to give constructional details of will overcome this difficulty with any portable gramophone and pick-up.

It has other important advantages besides, the most important of these

READILY DETACHABLE

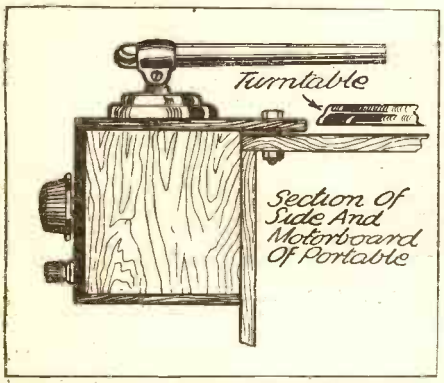


Fig. 1.—The adaptor unit is attached to the gramophone motor-board with the aid of plugs and sockets. The unit has two plugs placed 2 inches apart, and these are inserted into two sockets on the motor-board.

probably being the fact that it does not make the portable gramophone useless as such. The pick-up can be taken off the gramophone in a second or two without tools and can be put back just as quickly when required.

It Does Not Spoil the Portable.

No damage is done to the portable gramophone; in fact, only two small holes have to be drilled in the motor-board, everything else remaining untouched.

The unit is described with an external volume control; but if the pick-up already includes one mounted in the base, this provision can be omitted.

The only parts required besides the volume control are two stout plugs and sockets of the type shown in the drawings, two terminals, a little half-inch-thick wood and a piece of ebonite 3 in. square.

Cut two pieces of wood 3 in. square and one $3\frac{1}{4} \times 3$ in. Cut also one piece 5×3 in. for the top.

[The drilling diagram is given on our "Radiotorial" page.] Screw the two side pieces, the top and the ebonite together, as shown, making sure that the pieces are overlapped in the same way as indicated. Do not screw the bottom piece in place permanently yet, or it will make it rather more difficult to wire up. Screw the pick-up in place temporarily on the top piece, as indicated in Fig. 1, placing it fairly close to the ebonite panel end.

Finding the Best Position.

Now take the pick-up and unit and place against the side of the portable so that the inverted "L"-shaped piece rests against the side and motor-board. Figs. 1 and 2 will give a good idea of the position required.

Now slide the unit along the side until proper tracking is attained. The most convenient way to find this position, if you have not got a template, is to insert a needle in the pick-up and adjust the whole so as

TRACKING DETAILS

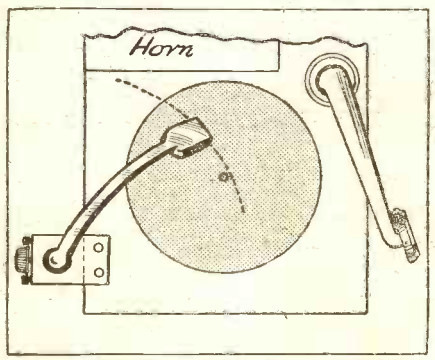


Fig. 2.—The dotted line indicates the correct tracking for the pick-up. The socket holes on the motor-board should not be drilled until the tracking position has been accurately determined.

to bring the needle half an inch or slightly less on the opposite side of the turntable spindle to that which the unit is on.

This will give approximately correct tracking with most types of pick-up, and it will be found that when the pick-up is swung across the record it will follow an arc similar to that shown in Fig. 2. Having got this position, hold the whole in place and mark carefully where the centres of the two holes come on the motor-board

Drill these points carefully and insert the two sockets tightly. Now insert the two plugs into the corresponding holes in the top of unit and screw up tight.

The unit will now be found to plug in and to lie snugly and extremely firmly against the side of the portable.

The Final Steps.

Check the tracking, and, if not quite correct now, adjust by moving the base of the pick-up very slightly and rescrewing when properly set. The volume control and the two terminals can now be put in place and the whole wired up.

The volume control is, of course, of the potentiometer type, and its value is always stated by the makers of the pick-up to be used. A view of the inside of the unit is shown in Fig. 3, and the method of wiring will be seen from this figure.

When the wiring is completed test out with a record or two to see if all is in order, and if so screw the bottom in place. No cover is needed over the side opposite the ebonite panel, as this is covered by the side of the gramophone.

As a final hint, remember to fix the unit well clear of the winding handle. It would be very disconcerting to get everything fixed up and adjusted only to find the motor could not be wound up!

[ED. NOTE: The idea of a clip-on pick-up unit was due originally to Messrs. Belling & Lee, Ltd., from whom such a unit in commercial form is available, price 35/- complete.

SIMPLE WIRING

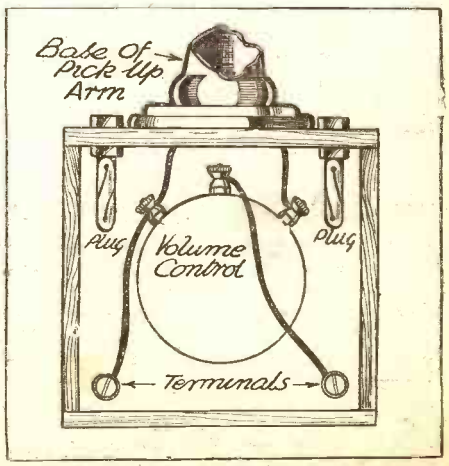


Fig. 3—The wiring for the pick-up and volume control is quite simple. The two terminals are joined externally to the pick-up terminals on the set or amplifier.

Miss Laurie Devine in the B.B.C. Television Studio.

WHITHER TELEVISION?

The presidential address by Sir Ambrose Fleming at the annual meeting of the Television Society (which was reported in POPULAR WIRELESS last week) has had wide repercussions in the world of Television. Here are some facts and opinions on the future of television as broadcast entertainment.

THE storm in a teacup over the supposed maladministration of British broadcasting has been quite overshadowed by the more important question of Television.

Rumours and denials have been tossed backwards and forwards between the various interests concerned. "Thirty-line television is going on"; "There will be no more television broadcasts"; "America is planning to capture the British market." These are but a few of the "official statements" which have followed Sir Ambrose Fleming's trenchant attack on the B.B.C. monopoly.

As we told you last week, Sir Ambrose's comments were brief and to the point: "Television has not yet had a chance of proving its utility. The B.B.C.'s attitude is over-cautious and unenterprising," he said.

The B.B.C., while preferring to disregard this challenge, has at the same time replied to at least one of the criticisms. In order that television may be seen by more people, there will in future be a transmission every Thursday morning at 11 a.m. (or 11.00 hours, as we shall soon have to call it!).

WHEN TO "LOOK-IN"

The B.B.C. has announced that from April 1st the days and times on which television transmissions will be given from London are:—

TUESDAYS - 11 p.m. (23.00 hours)
THURSDAYS 11 a.m. (11.00 hours)

Each transmission will last for about half an hour.

An American "Invasion?"

But while this change is, possibly, for the good, it appears that the entertainment value of television is not considered by the B.B.C. of much importance. An official tells us that the new arrangements, while continuing until further notice, will be limited partly by the use made of the transmissions by experimenters and partly by the rate of development of high-definition systems.

In other words, while there will be only an hour a week of 30-line television, even this is liable to stop at any minute.

Just as interesting are the views of the two commercial firms most concerned.

While neither Baird Television, Ltd., nor Electric and Musical Industries, Ltd., will make any official statement regarding Sir Ambrose Fleming's contentions, this is understandable in view of the fact that, until the B.B.C. decides which system it is to use in the future, both firms are more or less pledged to indulge in no publicity.

At the same time, the two firms would welcome the chance for a more unrestrained opportunity to let the public know of the merits of their respective systems.

Nor can we disregard the progress which has been made by A. C. Cossor. Although there is no foundation for a statement made in a certain newspaper that the Cossor system was in process of being tested by the B.B.C., the results which have been achieved in demonstrations of this system are remarkably good and we are sure to hear more about Cossor television in the near future.

But the most startling situation is provided by the United States. The visits of a number of men prominent in the radio entertainment world of America to this country have given rise to a very strong rumour that American interests intend to make a real effort to establish seven-metre television transmissions in Britain.

7-metre Receivers Ready.

The rumour is lent weight by the fact that a prominent American manufacturer is in a position to supply seven-metre television sets complete for the price of an ordinary mains radio receiver.

News of this was conveyed to the Radio Manufacturers' Association last week by POPULAR WIRELESS. Although the R.M.A. had had no previous intimation of such a position, they would undoubtedly do all in their power to uphold any British system of television against a foreign "invasion."

A newspaper report—attributed to E.M.I.—said that the firm's managing director, Mr. Louis Sterling, was bringing a new system back with him from America which would give "flickerless reception, clear speech and sharply defined characters." But this report was vehemently denied to POPULAR WIRELESS by an E.M.I. official.

The Crystal Palace Experiment.

The Baird Company created an innovation in company practice by depositing its chairman at the Crystal Palace and transmitting his figure and speech to a meeting of shareholders in Wardour Street. At the same time we were officially told that, while the authority of the B.B.C. to have a monopoly of television was not in dispute, the Baird Company was in a position to give its own television transmissions over an area comprising some 10,000,000 people.

SIR AMBROSE FLEMING.

That is the position to-day. Despite Sir Ambrose Fleming's whole-hearted attempt to free the progress of a new technical development from, virtually, a Government department, there is little likelihood of any change being made in the present arrangements.

"Press Button B!"

How listeners may one day be able to express their opinions on the programmes directly after a broadcast!

"THIS is the National programme from London. To-night we are broadcasting a concert of chamber music. We are anxious to know what listeners think of this programme, and we should be glad if, at the conclusion of the hour, you will press, and hold pressed, the button on your set indicating whether or not you wish to have more of this music."

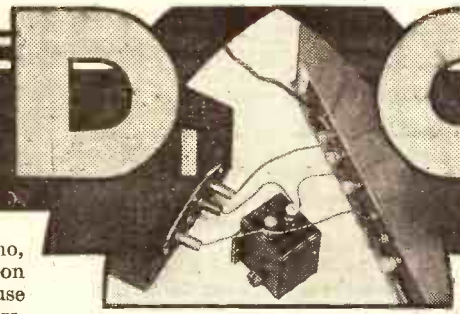
Such an announcement is not outside the realms of possibility if a message from Paris is to be believed. Dr. Hopkins, a well-known American inventor, claims to have devised a method by which listeners can "answer back."

Each receiver is fitted with two buttons marked "Yes" and "No," and the broadcasting station has high-speed equipment for recording automatically the listener's opinion of a question asked.

According to a newspaper report, "a number of individual and independent battery-driven sending stations, all adapted to propagate short-wave wireless energy, flash the results simultaneously upon an electro-magnetic control from a master keyboard."

Readers may draw their own conclusions from this brief summary of the method of operation. Certainly the ability to express extreme displeasure would give an added zest to listening and might lead to some unexpected results in the "fan-mail" department of Broadcasting House.

USING D.C. MAINS



There is no good reason for the lingering prejudice against using D.C. mains for radio, and this easy-to-understand article explains why. A few common-sense rules have to be followed, as with any other type of set, and then the D.C. mains are an almost perfect means of ensuring an ample and constant supply of power.

THERE are, no doubt, many readers who, having direct-current mains laid on to their homes, would like to make use of them for driving their radio receivers, but, having heard various exaggerated tales about their being unsafe and not suitable for the purpose, have contented themselves with battery drive.

It Is Extraordinarily Straightforward.

The purpose of this article is to show how easy to build and satisfactory a D.C. set really can be, provided a few simple precautions are taken. A direct-current receiver is extraordinarily straightforward in construction, and is considerably less complicated than its A.C. counterpart.

The main thing to remember when building a set of this type is that the receiver is connected *direct* to the mains and not isolated by a transformer, as is the case with one of the A.C. variety. It is necessary to bear this point in mind, because it is common practice to earth one side of the supply at the generating station, and it would never do to join an earth wire up to the receiver if the earthed main happened to be the positive!

The reason for this is, of course, obvious, for the earth terminal on the set is normally connected to H.T. negative, and as the positive main would be earthed at the station the result would be to short the mains. And I feel sure readers will agree that this is not a very advisable thing to do.

As it happens, it is very easy to get over this difficulty by inserting a large fixed condenser in the earth lead to the set, as is shown in Fig. 1. Without the condenser, connecting an earth to the set would have the disastrous result referred to, but in the arrangement illustrated the large condenser (generally about two microfarads) acts as a block to the supply, but at the same time does not resist the passage of H.F. currents.

The Insulation Must be Good.

This condenser should be of good insulation and capable of withstanding the full voltage of the mains for an indefinite period. It should be included in the set itself and placed near the earth terminal, so that the earth proper will be joined to one side and all the points in the receiver that normally go to earth connected to the other terminal.

The above is precaution number one, and is the most important safeguard to be taken in all D.C. receivers. If a D.C. mains unit is employed with an ordinary battery receiver it is usual for this condenser to be included in the unit. It will then, of course, be necessary for the earth to pass through the eliminator first.

Those Aerial "Shocks."

The next important point to watch is to see that another condenser is included in the aerial lead. Although the omission of this component will not result in any such spectacular occurrence as shorted mains, it is quite possible that it would be the cause of undesirable shocks being obtained from the aerial if any person happened to touch it.

The why and wherefore of this disturbing fact is not difficult to understand, and if you have a look at Fig. 2 (a) and Fig. 2 (b) it should be quite clear. In the first instance, the circuit is completed through the person touching the aerial wire, who therefore receives a shock; but in the second sketch he or she is saved from this unpleasant experience by the condenser.

Many receivers already have such a condenser in circuit for varying the selectivity, when it is, naturally, of the small variable or semi-variable type. In cases such as this there is no need to worry about any further precaution in this direction;

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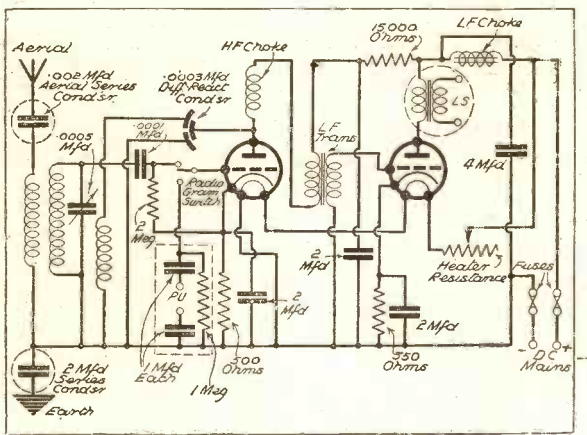
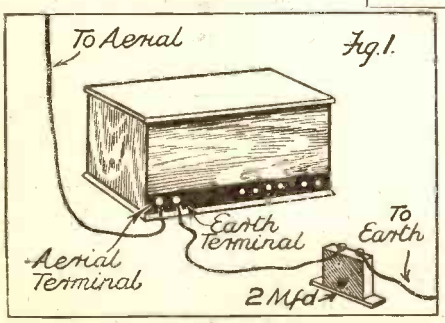


POINTS TO WATCH

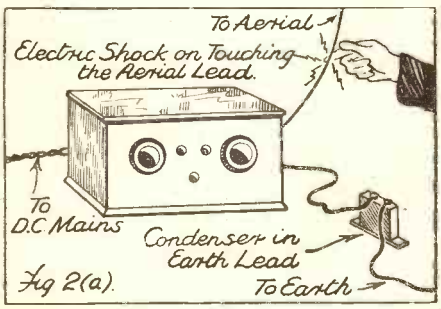
In the typical circuit diagram to the right, dotted circles have been drawn round the points in a D.C. set that may need special attention. Although a triode output valve is shown, the points emphasised are equally important when a pentode is employed, and practical hints on operation and upkeep for either type of set are given in the accompanying article.



The sketch above shows the simple precaution that must be taken with all D.C. sets—the insertion of a large condenser in the earth lead. In practice it is generally inside the set itself or in the associated mains unit.

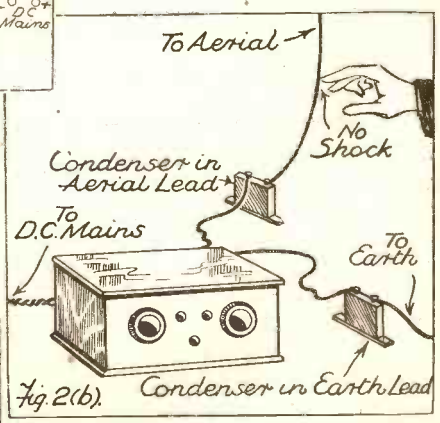
Some Useful Hints on—

THE EARTH-LEAD CIRCUITS—PREVENTION OF "TINGLING"—PICK-UP CONNECTIONS — LOUD-SPEAKER WIRING—POWER TAKEN FROM MAINS—WHAT CONDENSERS TO USE ETC., ETC., ETC.



A SIMPLE REMEDY

to prevent a "tingle" from the aerial is the condenser shown below.



To the left is illustrated an effect commonly experienced when the positive D.C. line is earthed by the supply company. It is cured as illustrated above.

but when the aerial comes direct to the top of the coil a condenser of fairly large capacity should be employed, so as not to upset the characteristics of the aerial circuit too much: ·002 mfd. is a good value.

There now remain two more places in the set that need attention, these being the pick-up connections and the method of joining up the loudspeaker. If it is not intended to use a pick-up, only the loudspeaker will have to be watched.

"Isolating" the Pick-up.

Dealing with the pick-up connections first, a pair of fixed 1-mfd. condensers are inserted in the leads, and, so that the grid of the valve shall not be "up in the air," a high resistance of about 1-megohm leak is joined between them on the receiver side.

Now, when dealing with the loudspeaker there are two methods of isolating it: one by means of an output transformer and the other with a choke-filter arrangement using two condensers instead of the usual one. Figs. 4 (a) and 4 (b) show the two schemes.

As a rule, it can be taken that the transformer is usually the most satisfactory, for if it is of the variable-ratio type it allows the speaker to be matched up to the output valve fairly easily and lacks the disadvantage of the two condensers in series, which must be of fairly large capacity if they are not going to cut down the low notes. If really good reproduction is desired they should be at least 8 mfds. each, or in any case not less than 4 mfds.

The same remarks do not apply to the pick-up condensers, however, for it is not uncommon to use capacities as low as 1 mfd. for this job.

The only other point in which a D.C. receiver differs from one of the normal type is in the method of connecting the filaments. With A.C. it is possible to step down the voltage by means of a transformer and so save wasted watts; but with D.C. the voltage must be broken down with a resistance.

The larger the current through the resistance the more energy is lost, and this is why high-voltage low-current valves are usually employed in sets working from direct-current mains.

One rather surprising fact about a D.C. set is that, no matter whether it be a little two-valver or a big six- or seven-valve superhet, the power taken from the mains is almost exactly the same; that is, provided the same types of valves are employed.

Very Economical to Run.

It simply means that in the larger set more watts are made use of in the valves and less wasted in the resistance than in the smaller receiver, where the mains voltage has to be broken down to just sufficient for the two valves in series.

The total consumption of the average D.C. mains receiver, working from a 200/250-volt supply, is in the region of 50 watts, which is not at all bad when it is considered that, even in a very large set, well over half of this is lost in the resistance.

On the previous page you will see a complete D.C. set in diagram form. It is a two-valver using 16-volt ·25-amp. valves, and it can be relied upon to give very good programme value. If desired the last valve can be replaced with one of the pentode type, in which case the correct ratio output transformer would have to be used and the auxiliary grid connected to H.T. positive.

Guarding Against Hum.

You will notice that one side of the heater of the detector valve is joined to H.T. negative; this is done to reduce the likelihood of trouble from hum being experienced. No matter whether the set be a two-valver or one of a larger type, it is always a safeguard against hum to start the earthed side of the heater circuit with the detector.

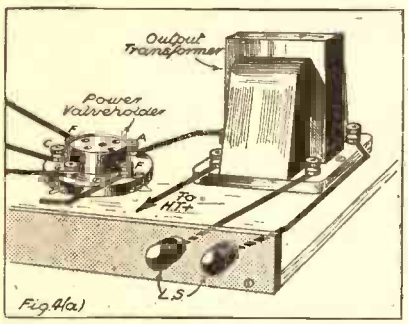
Dotted lines have been placed round the parts in the circuit where special precautions have to be taken, and which are mentioned in this article. If you trace out the circuit carefully it will help you to understand why they are necessary.

Before closing there is one other point that should be covered, and this concerns the cabinet for the receiver It should enclose the receiver completely, and the lid should not be opened without first withdrawing the mains plug, for, unless the operator is standing on some good insulating material, it is possible to obtain a shock from almost any point inside the set. **F. B.**

USING D.C. MAINS

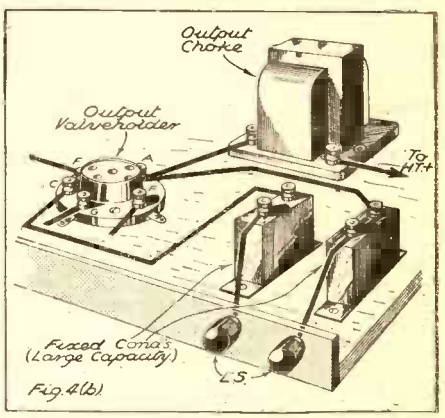
(Continued from previous page.)

FOR THE L.S. LEADS



If an output transformer is employed the plate current of the output valve is restricted to the primary, so long loudspeaker wiring can be taken from the secondary without any possibility of trouble from mains shocks.

EASY PROTECTION



In this choke-filter arrangement the condensers isolate the loudspeaker from the H.T.

THE LISTENER'S NOTEBOOK

An impartial commentary on the programmes, and some frank opinions on the recent methods of presentation and the success—or otherwise—of microphone personalities of the moment.

MR. VAL GIELGUD has set us all thinking. That in itself is a good thing. By his act he has made dramatic critics of us all. If he will allow himself to be influenced by the public's opinion something may be evolved that will be generally more acceptable and settle the drama's place in broadcasting once and for all.

* * *

I wonder whether Mr. Gielgud came across the remarks of a certain adjudicator at a recent drama festival. This is what the adjudicator said: "Acting is nothing more than mesmerism. An actor has to convince the audience that he means what he says. Acting can only be done with an audience and an actor. There is no such thing as acting on the films. It is impossible to act without an audience, because there is no mesmerism."

A Very Decided Statement.

"There is no such thing as acting on the films!" Well, that's straight from the shoulder, if you like! What about the radio? I wish this adjudicator had thought to mention acting before the mike. Although he didn't, I'm inclined to think that if he were tackled on the point he would classify radio drama with the films.

* * *

I am with him to a certain extent. I have repeatedly argued in these notes that an audience is indispensable to variety and music hall. For the latest example in support of this take the bill in which Will Hay and his Scholars figured. Barring Olympia, this performance is the nearest approach to the real music hall or variety show ever put on the wireless. Will Hay, and Mabel Constanduros before him, were quite inspired by the audience. The way the audience egged them on and the way they responded were really marvellous. The atmosphere was complete.

Did You Hear Him?

I don't know whether it was by accident or design, but *someone* seemed nearer the microphone than the rest. His laughter which was restrained but none the less genuine for that, made a sort of link between listeners and the audience there present. There was never a suggestion of the cold shoulder that so many listeners generally complain of. We were all one, both inside and outside St. George's Hall, and all victims of Will Hay's mesmerism.

* * *

But to return to radio drama. How could an audience improve it? I believe it could improve the playlet if only it could be induced to come and see more than one of them. But I'm afraid it couldn't. As regards the big play, excellent as it is at present, an audience, I am sure, would make it better still. I think it would make pretty much the same difference as there is between a full-dress rehearsal and a pukka performance of a stage play.

That Lack of Inspiration.

Miss Beatrice Lillie is reported to have said the other day, in answer to the question, "What is the greatest source of inspiration?" "My audience; I just can't help feeling spontaneous on the stage, and even if I feel miserable beforehand, one flicker of response from my audience and I feel fit for anything."

* * *

But the wireless actor or actress never gets that one flicker of response. I would like to hear an expression of opinion from one of them on the matter.

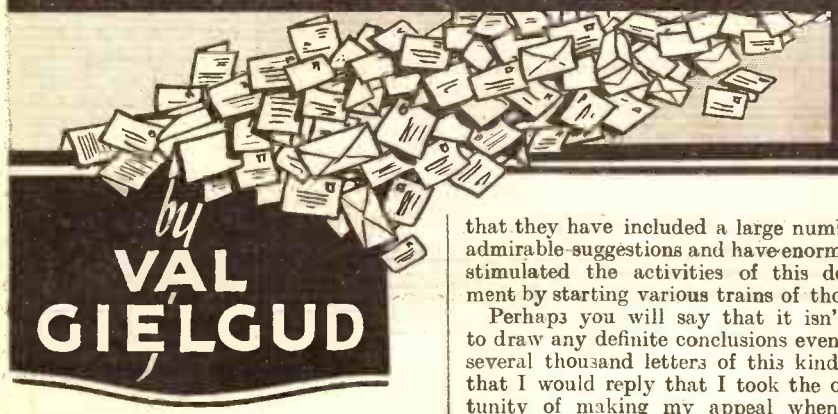
Some Excellent Effects.

I am afraid I am too prone to compare broadcast drama with the stage. I've never felt that the former has eclipsed the latter, except when there has been something in it that is impossible to do in a stage production. In other words, when a clever use of effects has made a broadcast play a unique thing. That Italian farce, "The Hero," for instance, had little merit. The plot was negligible and the dialogue wasn't much better. Though the acting was generally good, particularly that of the hero himself, the play would have been a flop on the stage. As a radio play, however, it was saved by the excellence of some of the sound settings. The cellars in the bank, the fire, the fire-bells, the aeroplane and the chorus of the Dynamite Club were wonderfully well done.

Mr. Lance Sieveking was responsible for these, and, provided he never becomes childish, I think he is moving along the right lines. Radio drama must have characteristics that differentiate it from the stage proper. If it

(*Continued on page* 97.)

TEN THOUSAND LETTERS!



by VAL GIELGUD

THE morning after the broadcast production of "Quarrel Island" I approached my office in a state of considerable trepidation. I had, you may remember, asked listeners to let me have their candid opinions on the subject of broadcast plays. What should I find?

I confess that I hadn't the slightest idea. But with five years of radio dramatic production behind me I couldn't help wondering whether I might not discover at any rate a vigorous demand for my own resignation, or—even worse—no response to my appeal whatsoever except for the five charming postcards from five people whom I know listen to every play that is ever sent out over the air.

I had hoped that it would not be as bad as all that. It wasn't. Within twenty-fours hours there were over a thousand letters and postcards accumulating in trays. Within three days there were ten thousand accumulating in sacks.

They are still coming in, and I am still doing my best to read them with the attention that they deserve.

Constructive Suggestions.

My principal feeling, apart from a slightly bewildered satisfaction, is one of extreme gratitude—gratitude, in the first place, for the confirmation of my belief that there really is a big audience for the broadcast play; gratitude, in the second place, for a definite majority opinion, to judge from the letters I have read, that our dramatic policy is neither insane, ludicrous nor generally unacceptable; gratitude, in the third place, because my correspondents have not only said that they liked plays and that they are apparently prepared to look forward to plays in the future, but because the average letter has not been a single sentence, but three or four pages long.

It is not an exaggeration to say that I have received several thousand short essays on broadcast plays, and that they have included a large number of admirable suggestions and have enormously stimulated the activities of this department by starting various trains of thought.

Perhaps you will say that it isn't fair to draw any definite conclusions even from several thousand letters of this kind. To that I would reply that I took the opportunity of making my appeal when, presumably, the largest number of the radio play audience would be likely to listen.

From Every Walk of Life.

I think, therefore, I am justified in drawing the conclusion that the people who replied are representative of the main body of broadcast play listeners. And though,

A week or so ago the B.B.C.'s Drama Director—Mr. Val Gielgud—appealed to listeners to write and tell him what they thought of radio plays, what kind of productions they wanted and what they would like to avoid.

In this article Mr. Gielgud himself tells you about the amazing results of this appeal.

much as I should like to, I don't dare to follow the conclusion of the Editor of "The Era" that my audience must be three million and a half, I believe that his figure is by no means so fantastic as a good many of our critics would have us think.

Who have written these letters? Almost everybody. Brigadier-generals have written from Bath and foremen have written from factories. I have received a startling impression of a cross-section of life all over England during this last week. A schoolboy of sixteen wrote on behalf of his school; one workman wrote on behalf of two hundred and fifty of his mates. Letters like these stand out in one's recollection. And at least sixty per cent start like this:

"My wife and I have just been sitting by the fire listening to your play"—and then they go on to say what they think about our work. Sentimentality and romanticism are out of fashion in these days, but I doubt if these days are the better for it, and to me the romantically sentimental quality of the impression conveyed by these hundreds of letters, coming from every kind of fireside, has been almost overwhelming.

It may be true, as some critics say, that one of the disadvantages of broadcasting is its inevitable inhuman detachment. To this I would retort that, personally, I feel most sincerely that I have just recently established not only a contact with my audience, but a very human and personal contact into the bargain.

But what have they said, all these letters? What have they asked for? I have not yet had time to make a properly detailed analysis. It is only possible now to give the general impression.

Approving Historical Drama.

But several points have definitely emerged. First of all, broadcast plays are listened to and are appreciated. Secondly, our new "line"—if I may be forgiven the expression—in historical and actuality drama has received emphatic endorsement. Thirdly, the established dramatists—Galsworthy, Shakespeare, Ibsen, Eden Philpotts—are at present preferred to the young brigade who are experimenting in the pure form of the broadcast play.

Of these experimenters only Mr. du Garde Peach and Mr. Philip Wade seem to have achieved the approval of the majority—though the works of the pioneers like Mr. Guthrie and Mr. Sieveking have provoked exactly those violent pros and cons which all good pioneers expect.

There is a strong tendency to demand more comedy and to deplore the preponderance of the tragic in our work. With this point I sympathise; but I would point out that the remedy lies rather with the authors than with us. I am afraid that comedy cannot be created out of the air!

The recently established intervals during the action of

(*Continued on page* 97.)

The B.B.C.'s Drama Director dealing with part of his vast post.

MONEY FOR PROGRAMMES

Latest news from "The Big House" about broadcasting and broadcasters.

Carroll Gibbons and Howard Jacobs with the Savoy Hotel Orpheans.

IT is now definite that practically all the new revenue accruing to the B.B.C. will be spent on programmes and the balance on engineering expenses. There are indications that expenditure on staff and organisation is stabilising.

The B.B.C. would be wise to give more detailed information of its budget. Members of Parliament in particular would be more confident if they were given the information to enable them to make independent analyses of the B.B.C. balance sheet and statement of accounts.

* * *

Sir John Hits Out.

Since he accepted the invitation of the Committee of Conservative M.P.'s to defend the B.B.C. constitution and policy, Sir John Reith has departed from his policy of silence in the face of hostility. And it is characteristic that when he does make a change of this kind he goes all out on it.

I understand that he will make several important public pronouncements during April.

* * *

Oliver Baldwin's Contract.

Mr. Oliver Baldwin will continue as B.B.C. film critic until the end of the June quarter. The B.B.C. did not allow Mr. Baldwin's public attack to interfere with the existing arrangement.

The film critic for next autumn has not yet been selected; but I hear rumours that Mr. George Atkinson and Mr. Sydney Moseley are in the running.

* * *

Summer Plans.

It will be good news that the B.B.C. plans for the summer foreshadow much more seasonable programme arrangements than ever before. There is to be a general lightening: less talks and much more popular music and entertainment.

* * *

The Outdoor Listener.

Special thought is being given to the needs of those listeners who will be taking their sets outside for summer occasions.

This will probably mean that light entertainment and dance music will be given at more universally popular times than during the winter months.

* * *

Television Pressure.

The B.B.C. is being subjected to much outside pressure in order to secure a reversal of the decision to reduce the number of 30-line television transmissions. I can say on the best authority that this pressure is being successfully resisted, and the new decision will stand.

* * *

"Ether Echo" Experiments.

Professor Appleton, the eminent radio scientist, is co-operating with other authorities abroad and with the B.B.C. in a series of experiments in the detection and measurement of "ether echoes"—that is, the reflection of signals from remote strata far beyond the Heaviside or Appleton Layers. Important results are expected.

* * *

A Better Empire Service.

Captain Cecil Graves, the Empire Service Director of the B.B.C., has now received authority to go ahead with a scheme calculated greatly to improve the quality and variety of the short-wave offerings to the Empire. He is being guided a good deal by the advice of Mr. Malcolm Frost, just back from North America.

* * *

Tauber to Broadcast.

Here is an advance announcement that the great Richard Tauber is to take part in the studio performances of "Frederica" for National and Regional listeners on Monday and Tuesday, April 23rd and 24th respectively. He will sing in German, but will use English for the dialogue.

* * *

St. George's Day.

St. George's Day and Shakespeare's birthday are always important events in broadcasting. Among the items which listeners will hear this year is a relay of Sir Austen Chamberlain's speech at the annual banquet of the Royal Society of St. George from the Connaught Rooms on Monday, April 23rd.

On the following day Val Gielgud will produce Clemence Dane's great classic play, "Will Shakespeare," in honour of the dramatist's birthday.

* * *

Relays from Cornwall.

It may be just a little early to itemise summer outside broadcasts, but the B.B.C. is compelled to plan so far ahead that no harm will be done in mentioning that this year listeners can look forward to hearing a number of relays from Cornwall. These will originate, of course, as part of the West Regional programmes, but there is every possibility of some of them being included in the National and other Regional programmes.

* * *

Seaside Resorts.

Relays will also be taken from North Wales seaside resorts, and there will be regular broadcasts of humorous and light entertainments as well as a fair sprinkling of concerts by Welsh bands and choirs.

* * *

Another "Divertisement."

Martyn Webster has another "Divertisement" programme on the stocks for Tuesday, April 10th. It will open with a relay from the Regal at Handsworth, where Wilfred Southworth will be giving his first broadcast, which is to consist of his own arrangement of Gershwin's "Rhapsody in Blue" for organ and piano. The pianist will be Jack Hill, a young artiste who has already given several studio recitals.

* * *

"Income Tax."

"Cavalcade of Love" should be equally entertaining as showing an elopement in 1894, in 1924 and 1934, and there is also a duologue called "Income Tax" by Herbert C. Sargent.

The interludes between the items will be filled by the Hawaiian Islanders and Harold Pollard (entertainer).

* * *

Donald Calthrop Again.

It seems a long time since Donald Calthrop took part in a broadcast programme, but that is hardly to be wondered at since he has been so busy making films.

On Saturday, April 7th, Donald is to play in "Old Yesterday," a romance in one act, which will be part of the St. George's Hall music-hall programme, in which Alexander and Mose are also appearing. Donald Calthrop was once dramatic producer to the B.B.C. for several weeks.

* * *

"Move On, Gipsy."

Lonely camp fires and adventures by the roadside and many other things that occur in the course of a year in a typical gipsy's life will be traced in music and speech during the North Regional programme on Tuesday, April 10th. The programme has been arranged by Ruth King, and is entitled "Move On, Gipsy."

In addition to music by Hungarian and Russian composers and literary material by Borrow and Starkie, it will include a description of the gipsy settlement which still exists at Yetholm, where a large community has always lived in huts and where is also the headquarters of the Gipsy King.

O.H.M.

ALTHOUGH there is quite a number of people who have been working on 5-metre reception and transmission for several years, last summer saw the first real enthusiasm among the great band of short-wave listeners for this fascinating part in our spectrum.

"Five" was always regarded as something rather uncanny, requiring expensive and complicated gear and a vast store of technical knowledge.

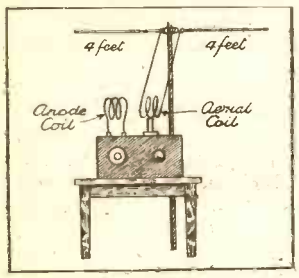
The coming of the simple super-regenerative receiver and the knowledge that there were certain definite transmissions to listen for roused the public interest in the ultra-short waves, with the result that our epoch-making tests from the Crystal Palace were a huge success.

I am constantly being asked what we all propose to do about it *this* summer. Unfortunately, I have to make the usual non-committal reply, but I have an idea that quite a lot of interesting developments may be expected.

FIVE METRES THIS SUMMER

Five-metre reception, which first became popular last year, is bound to receive considerable attention this summer, and all those attracted by this band will be interested in the suggestion contained in these notes on the subject.

A USEFUL STAND



This miniature table for the S.W. receiver is what W. L. S. calls his patent "dumb-waiter."

Although I know that many will violently disagree with me, I do think that it is going to be sheer waste of time to try to break any more "DX" records. We have shown that 5 metres will cover 200 miles on low power, but we probably couldn't repeat it on six successive days if we tried for years.

What, then, is the object of trying to get farther? What we want is to develop the wavelength over ranges which can be *reliably* covered.

It is Wonderfully Simple.

We must not lose sight of the fact that the chief usefulness of "five" is the beautiful simplicity, and therefore portability, of the apparatus. One can almost go hiking with a 5-metre transmitter and receiver, and the owner of a small car can carry quite a young broadcasting station about with him. The two sketches on this page both deal with the "portable" aspect of the ultra-short waves.

The first shows my own patent "dumb-waiter" scheme for a transmitter and receiver out on field work. A little table with collapsible legs and castors is all that is required; and if one doesn't care what other people think the homely perambulator is excellent!

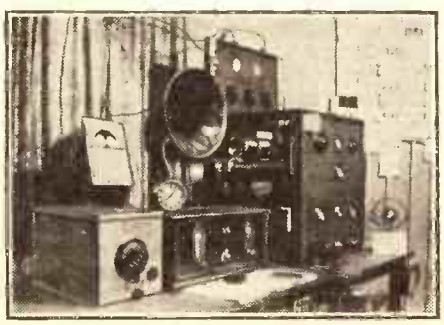
The second sketch shows a typical transmitting aerial mounted on a small car. The gear is on the rear seat; the aerial runs from the "fishing-rod" to the front end of the sunshine roof; and from that point a feeder, or pair of feeders, slopes down inside the car.

Will You Help Us?

I used a scheme similar to this in Yorkshire last year, but our results have already been told in detail.

What I should like for the coming summer, above all things, is this: I want a register of the names of readers who are prepared to collaborate in any kind of outdoor 5-metre work, together with some idea as to their resources for setting up field receiving stations.

FROM SOUTH AFRICA



This photograph shows Mr. R. Keir's station, Z S 6 Y, in the Transvaal. It is frequently heard in this country on 21 metres.

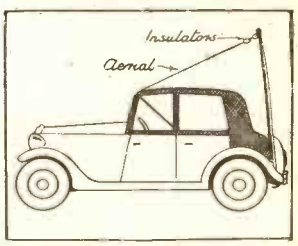
Several of my transmitting friends have already built complete mobile stations, and my own is nearly finished. We are hoping to hold a series of week-end field-days, choosing suitable sites in hilly country.

While there would not be much chance of our signals being heard in towns with badly screened aerials, the thought that a score or more of people were all sitting about on hill-tops ready to listen at a predetermined time would be no end of encouragement.

As I write these notes, with a thunderstorm passing overhead and a charged aerial sparking happily away on the other side of the room, the mere thought of field-days makes me shiver; but when our summer arrives there is no more pleasant way of combining one's favourite hobby with a week-end of fresh air than a field-day.

I hope that any amateur transmitters who read this page will send me any suggestions or offers of help. I'm all ready to do my bit (chiefly with a portable transmitter) and several of the "South London Gang" are as keen as mustard. All that we want now is a little co-operation.

FOR CAR USERS



A car with a sliding roof is ideal for fixing up a portable transmitting station.

During the next few weeks I hope to deal with matters connected with the ultra-short waves, including the design of a good 5-metre receiver. I may as well say at the outset that I haven't yet evolved anything much better than the one that was described so fully last year.

List of Names to be Compiled.

I must confess to a strong partiality for the superhet, but it's quite useless for portable work unless one has a car, and even then it's not too convenient.

If you are the least bit interested in the plans for the coming summer, please sit down *right now* and tell me so. I will keep a record of all names received, and the readers concerned will be notified of any interesting developments.

On the Short Waves.—Page 2.

TUNING Your Short-Wave Receiver

Do you have any difficulty in tuning-in short-wave stations ? If so, you will find these notes on operation and the handling of controls a great aid to obtaining the best results from your receiver.

THERE is nothing like first-hand experience for teaching one a lesson. I write this with feeling, for during the past fortnight I have acted as doctor to quite a few cases of short-wave troubles and have learned from them quite a considerable amount.

Perhaps I may be pardoned for confessing that I imagined, until recently, that my own short-wave experience had brought me in contact with most of the worries that are likely to beset the beginner. After all, I have been working at them in some shape or form since *before* they were really discovered. But I freely admit that the last fortnight's experiences have been an eye-opener to me.

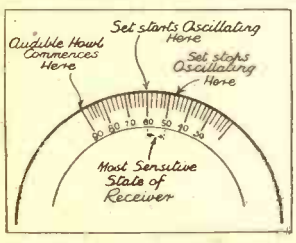
He Was Completely Lost.

I hadn't the slightest idea how completely lost, how absolutely *fogged* the short-wave novice can be when he takes over his first set. The short waves seem to bear so very little resemblance to the rest of radio.

It is out of pure compassion, therefore, that I am trying to put myself in the position of the novice handling his first short-wave set and to anticipate a few of the troubles with which he will meet.

One gentleman of my acquaintance, Mr. A., had an absolutely perfect set in front of him. Everything about it was good—sensitivity, selectivity, reaction control—no hand capacity, no threshold howl; in fact, the sort of set that most short-wave folk dream about as an ideal. And could he get anything out of it? No, not he!

REACTION OVERLAP



If oscillation stops at a different reading from that at which it starts, as indicated here, overlap exists and you must endeavour to remove this.

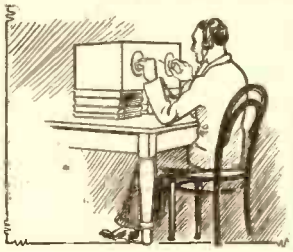
Let us examine *his* particular snags. First of all he hadn't the remotest idea of what "delicate touch" meant. He simply couldn't touch his tuning dial without jerking it violently through four or five degrees.

As always, I asked *him* to operate the set while I listened; and there was our old friend, "ham-handed Henry," of Writtle days, back in the flesh again. He swished and he swooped, and covered four or five perfectly good signals all at once, finally turning to me and saying: "There you are, old man; you can't hold anything."

I wasn't annoyed with him; his trouble was so pathetically genuine. And it was so difficult to explain to him tactfully that he hadn't the remotest idea of operating a set. Cutting a long story short, I took over the dials and produced station after station with the air of a conjurer producing rabbits, watching his incredulous expression grow more intense until I thought the strain must be too great.

He has now cultivated a steady hand and a quality of patience that was not there before, and all is well. You will note that this particular "Short-Wave Trouble" had nothing whatever to do with the set. It all boils down to the fact that short waves are different from anything else in radio and need different treatment.

SIT AT EASE



Comfort for short-wave listening is very important, and sometimes the accessibility of the controls may be improved by raising the set on some books.

Let us examine this business in detail. First, the reaction control, which is the most critical and most troublesome feature of a good many sets, be they short-wavers or not. The first thing that one *must* do is to find the point at which the set goes into oscillation and have a jolly good look at it. Does it just go over with that nice reassuring hiss? Or does it howl or bark at you? We will assume, for now, that it "hisses" in the most well-mannered way, because this article isn't concerned with technical troubles.

Now, incredible as it may seem, quite intelligent people that I have met tell me that they don't think a set is oscillating unless they hear squeals and cat-calls.

A Fierce Reaction Howl.

So what do they do? Why, they go on increasing reaction until the set bursts into one of those devastating L.F. howls, and *then try to tune in a station.*

Let us get this quite right. As you increase reaction listen carefully. When you come to a place at which, with the slightest suspicion of a "pop," the set starts hissing very gently, *then* you have reached the setting at which to search for stations. The reaction control should *always* be held as near this setting as possible. Certainly it should never be moved beyond this.

Now for the operation of tuning. With the set just oscillating, and one hand on or near the reaction control, rotate the tuning knob slowly and steadily. If you can read Morse you will probably find a C.W. signal of some sort on almost every degree.

If you are after telephony, carry on with the search until you come to a carrier-wave that is continuous—i.e. unbroken by dots and dashes, whether slow or fast.

Bringing in Telephony.

Then, instantly, reduce the setting of the reaction control, so that the set is just *under*, instead of just *above*, the oscillation point. The actual movement on the rim of the reaction knob will probably be only about a thirty-secondth of an inch, so don't be clumsy. A mere touch, one way or the other, on the tuning dial will now be necessary to bring in the station.

When you are more experienced this will become one simple and continuous operation instead of a series of small jerks.

A TESTER MADE FROM AN OLD VALVE SOCKET

Details of a useful little gadget.

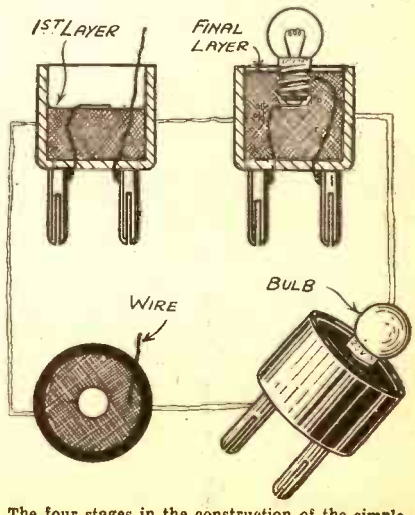
OLD valve sockets can be used for testing by converting them in the following manner: Take two holders and remove the pins not required in each case. You will now have two plugs which can be inserted in the set across L.T. or other points as required.

Solder lengths of wire to each metal plug, cut one off to about half the depth of the ebonite shell, and solder a tin contact to the end. Half fill the holder with melted pitch (or paraffin wax will be easier), leaving the contact exposed on the surface. Place a small bulb in position with the contact touching, and run more paraffin wax up to the level of the screwed part of the small bulb.

Forming a Thread in the Wax.

The other wire (which should be flexible) should have been placed so that the end will be embedded in the thread made by the wax around the bulb. When dry the bulb can be unscrewed (the bulb should be an old one for preference, as the new one can take its place). The contacts can be scraped clean, and with two of these sockets many tests can be performed, using a small pocket battery.

W. G.



The four stages in the construction of the simple tester which is described above.

The quest for "perfect" reception must necessarily be bound up very closely with the method of transmission. Our Chief Radio Consultant suggests a comparatively simple method of avoiding sideband interference without altering the present wavelength separations. But he is afraid that this, like other really progressive schemes, will not be brought into practice by European broadcasters!

I HAVE written two articles on a subject. This is the third on that same subject.

The articles were introduced by the question: "I want a receiver, regardless of cost, to give me perfection. What should I do?" It was not put quite like that—but that's a good enough précis.

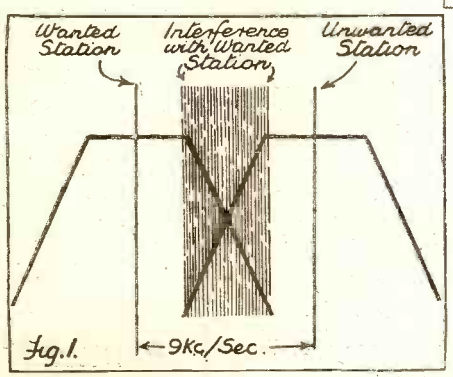
I seem throughout the series of articles to have avoided the answer and talked mostly about the conditions of transmission. But this is logical. You do not design motor-cars regardless of road conditions; you do not design domestic electrical apparatus without a concern for the dimensions and environments of an average home.

A Strong "Local" Field over Britain.

The conditions of transmission determine absolutely the prevailing ideology of receiver design. When broadcasting began, and I had established a strong "local" field all over Britain, and before Europe had copied my ideas, and when distant stations were weak, the common receiver had hardly any "tuning" at all.

Then the Regional Scheme demanded some selectivity. Now the raising of station power all over Europe has brought the problems of selectivity to a paramount importance.

I have shown you how the problem to get selectivity and quality is solved, to the extent which the limitations imposed by the futilities of transmission allow it to be, by having a receiver which accepts the carrier and one set of sidebands of the wanted station and *completely* rejects all other frequencies. The ideal receiver is one with a narrow movable window (the sides of which extend downwards into hundreds of decibels!), but just wide enough to see all that is worth seeing.



AS IT MIGHT BE

Above is an illustration of what would be achieved with single sideband transmission. The present 9-kc. separation would be sufficient to obviate all sideband interference by even the most powerful stations. Although the cost of installing the necessary apparatus at the transmitting end would not be prohibitive, listeners would be limited to one type of receiver.

And I have shown you that it is easier to construct the "perfect receiver" if you use the superheterodyne principle. You can, by using the beat principle, design this desirable narrow window—this flat-topped band-pass filter—for a fixed invariable frequency.

Lastly, I ask you to recollect that, whatever is done, it is fundamentally impossible, in the present conditions of transmission, to get perfection, because stations inevitably splash over into each other's territory—the upper frequency sidebands of one are on the same frequency as the lower frequency sidebands of the other.

Once more I have clearly shown this phenomenon in the picture in Fig. 1. Here you see the picture of the state of affairs where the fields of two stations are equal. They each invade each other's frequency territory.

If you are compelled to accept the bands of frequencies between the carrier of the wanted station and its sidebands, some of these sidebands must be cut off, because interfered-with quality will be lost.

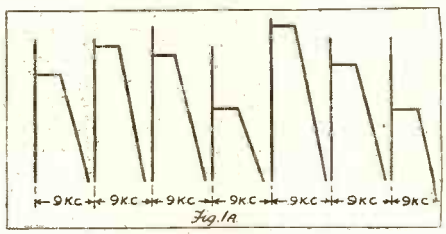
Now, what I am going to say has importance. This is the first time in broadcasting history—so far as I know—that the proposal I am about to make has been seriously put forward.

Suppose that the authorities were persuaded to send out only one set of sidebands plus carrier. This arrangement would ensure that the "spectra" of broadcasting stations would never overlap.

The rest of the problem lies with the receiver. I am very well aware that a great many problems remain to be solved, but they concern reception. And, in my mind, and taking the broad view, the problems would eventually get solved. They always do, given a proper demand for their solution.

THE PRESENT SYSTEM

In the diagram below you can see how two stations, each radiating a carrier, and two sidebands, interfere with one another over the shaded area.



What are the disadvantages? First, that a receiver, now designed to embrace carrier and two sets of sidebands, would get half the strength of signal and the same amount of background noise.

Solution—the superheterodyne receiver. Difficulty—this is more expensive than the other type. Answer—not necessarily, and when technique is studied.

For instance, when I introduced long-wave broadcasting they said: "But this will make the receiver very much more costly." It did at first, but now European receivers are not more expensive than Australian, Canadian or American receivers where long-wave broadcasting does not exist. In certain instances the contrary is the case.

Another argument is that it would be a costly matter to equip every European station with the necessary filters to "cut off" completely one set of sidebands.

That is true: it might, at a station like Brookmans Park, cost of the order of a thousand pounds to do one transmitter; but even if we say it's going to cost European transmission a quarter of a million pounds, one must recollect that perhaps twenty million people listen to broadcasting in Europe, and the capital cost of the change, per listener, does not come to more than a few pence. And the gain would, in a few years, be tremendous.

Reasons for Turning It Down.

Of one thing you may rest assured: that if and when the proposal is made "officially" there will be plenty of reasons for turning it down.

I said the proposal was important. It is, even though no one will officially take much notice of it. It is important because, if adopted, it would *eventually* greatly ameliorate the listeners' conditions of reception. It would allow one to design a receiver which gave very good quality, even though the transmitters were only separated by 9 k.c./sec.

It would, it is true, cause dislocation. It would, so far as we can see at present, force us to use a particular principle of reception. But why not—if, in the end, it is a better principle?

One of the Wearite screened coils which have made the new "P.W." set possible.

The Need For Selectivity—

Why POPULAR WIRELESS has designed "The New Everybody's Three."

UNDER the Lucerne Plan the majority of countries in Europe decided—on paper—that wavelength wandering of their broadcasting stations should cease. In practice plenty of frequency wobbling is still taking place, and heterodynes are by no means unknown.

Selectivity, and more selectivity, is still the cry of listeners, not only because they want to get foreign programmes, but because they need razor-sharp tuning to pick many of the British stations out of the welter of wavelengths.

Lucerne Plan Requirements.

The fact that the Lucerne Plan decrees very accurate frequency adherence by the stations that come under it also necessitates radio receivers that will be capable of very fine tuning, for the separation of the various stations is very small, and any spread of the receiver tuning is bound to result in "muddy" reception, even if actual heterodyning interference is not present.

The problem of clean tuning is aggravated by the increase in power of numbers of foreign broadcasters, so that the unhappy owner of a non-selective set is always hard put to it to pick out any programme, other than his close local, absolutely clear of interference.

No Interaction.

To provide really sharp frequency selection in simple sets, some new screened coils have been placed on the market by Wearite, and these are used in "The New Everybody's Three," to be described in next week's POPULAR WIRELESS.

It is a simple three-valve set possessing a degree of selectivity that is astounding, especially when one considers that the coils that give it such razor tuning cost a matter of a mere 5s. each.

The coils are air-spaced and enclosed in a very strong metal screen, which completely precludes any possibility of interaction between them—a state of affairs that would immediately ruin the high degree of selectivity achieved by the set.

THE NEW PINLESS VALVES

Details of the latest universal mains types.

AS announced last week, Mullards have discarded the old-established method of valve mounting in their latest range, in favour of a fresh method. This consists of valve bases with studs instead of pins, fitting into holders with spring side contacts instead of sockets.

A more astounding change is the separation of the grid connection from the others in the same manner as has been popular in America for many years. The grid connection is made to the top of the valve—the position so familiar as that of the anode of the S.G. valve.

The new valves comprise a large section of a universal range for D.C. or A.C. operation, and include a "fixed" H.F. pentode (S.P.13); a multi-mu H.F. pentode (V.P.13A); an octode frequency changer (F.C.13); a double diode (2 D.13); an output pentode (Pen. 26); and a half-wave rectifier (U.R.1).

With the exception of the Pen. 26, which has a 26-volt heater, and the rectifier, which needs 20 volts, all the valves have 13-volt heaters. This brings them under the suitable-for-car-radio category. They all take ·2 amp. and are indirectly heated.

The new Mullard 2D.13.

It will be noted that the diode is a simple rectifier and not of the multiple type with triode, tetrode or pentode incorporated. The reason is that Mullards are reported to be definitely against the principle of multiple-function valves in this series, apart from the frequency changer.

The output pentode has an anode dissipation of eight watts and a mutual conductance of 3·4 ma/v. The rectifier gives 75 milliamps at 230 volts R.M.S. on the anode. The valves, including the diode, are designed for 200-volt anode potential, with the exception of the pentodes, which will take 250 volts.

The H.F., octode and diode valves are metallised with the metallising connected to a separate contact on the base.

Another no-pin range—of two types, so far—has been brought out by Marconi in the L11 and H11 midget valves. These tiny amplifiers are for police sets, deaf-aid amplifiers and other receivers that have to be very small in dimensions.

The valves have contacts similar to the valves just discussed, but only four of them, as they are battery triodes. The filament voltage is 1 and the current ·1 amp. The anode potential is 100.

In the case of the L11, the impedance is 12,500 ohms and the amplification factor is 5, while the H11 gives an amplification factor of 15 with an impedance of 30,000 ohms.

Some idea of the size of the valves may be obtained from the fact that, except for the width of the base, which is just too great, you can easily get one into an ordinary match-box. The exact measurements are height 60 m.m. and the external width of the valve-holder into which the base fits is only 26 m.m.

SIR JOHN AND HIS CRITICS

The Director-General scores a victory in the House of Commons.

THE much-publicised battle between Sir John Reith and a gathering of M.P.s. concerning the administration of the B.B.C. seems to have ended in complete victory for Sir John.

Much of the criticism was disposed of in a very short time, while the suggestion that Broadcasting House was seething with discontent at the rigorous, almost military, discipline enforced was negatived by the production by Sir John of the memorial signed by 800 members of the staff indignantly repudiating any such suggestion.

Whatever the reason for the hostile campaign that has been carried out, and which the Director-General of the B.B.C. so ably swept aside, there seems little, if any, real foundation for it.

The suggestion that a "specialist" should be at the head of affairs in Portland Place is a ridiculous one. There are specialists looking after the various departments of the B.B.C—dramatic art, variety, television and so forth—and this is right. But how could one specialist, or even two, look after the whole administration of the Corporation?

Position of the Expert.

A variety king would be hopeless in financial matters, while a dramatist at the head of affairs would seriously upset the equilibrium of, say, the children's hour people or the light variety and dance band organisers.

What is required is a chief who is a student of psychology: someone who is used to and expert in the handling of men and women; someone who will weigh up suggestions and make decisions covering the naturally vast scope that a concern like the B.B.C. must cover. And that person is there now.

Sir John Reith and his colleagues at the helm of British Broadcasting have excellent advisers on technical matters covering the whole scope of the B.B.C., and have proved themselves remarkably amenable to expert advice.

The accusation that the B.B.C. is too inflexible is not well levelled. For a concern of its size it is reasonably flexible, and the reins of administration have been held in sensitive though strong hands.

In our opinion the anti-B.B.C. campaign, which Sir John Reith countered so well, deserves no credit.

The CONTRA-PHASE 4

Capable of working a large moving-coil loudspeaker at "mains" strength and quality, this special "P.W." design is nevertheless extremely economical to run. Class B output and an economy driver stage are automatically worked either from the detector alone or from an S.G. det. combination, the special Contra-phase control thus giving the set a most useful flexibility.

By the "P.W." RESEARCH DEPARTMENT.

THE many special features of this design entail one minor problem in presenting it to our readers. The difficulty is to know how best to utilise the space at our disposal for describing it!

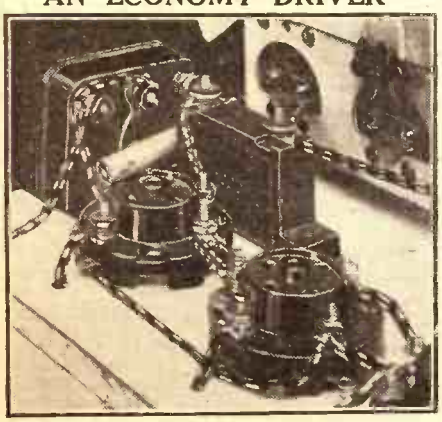
The fact that the set is a four-valver, which automatically converts itself into a "three" when adjusted for local-station reception, obviously calls for comment, because it is such an important point to those for whom running economy is a first necessity.

Further, the circuit is so unusual and pleasing that we are tempted to enlarge upon that aspect of the design: for its advantages are such that they need only to be detailed to achieve instant popularity amongst the discriminating.

Perfection of Quality.

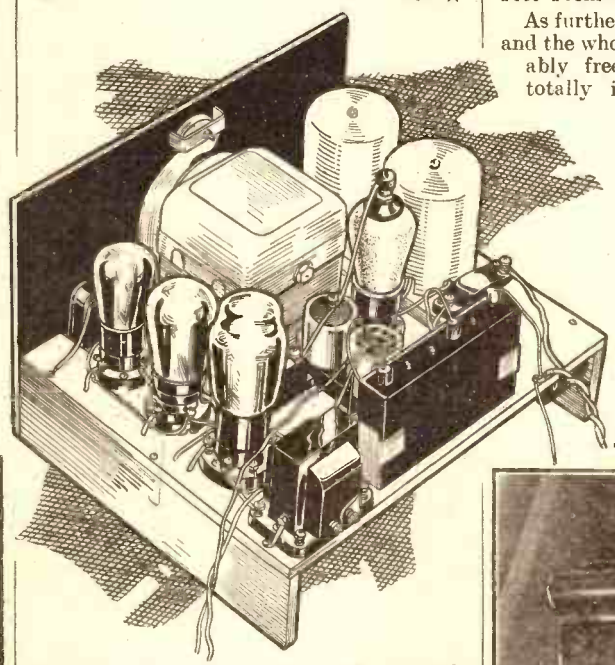
In addition, we have to deal with the Class B output stage, giving the set that adequacy of power and perfection of quality which are still popularly associated only with mains-driven apparatus. (Many battery owners are naturally still somewhat incredulous about this new development, hardly realising how they are now free to obtain "mains quality," so we would like to explain how this is done in the Contra-phase Four.)

AN ECONOMY DRIVER



And finally there is the question of construction and of how best to operate the set, so that every builder of the design shall get with it the amazingly good results that we ourselves obtained with the original model.

In last week's article we could touch only briefly upon these subjects. But fortunately the construction is such a straightforward and simple job of work that little need be said about that aspect of the question.



The Contra-phase simply bristles with interesting points, as the photographs of its construction indicate. For example (left), the driver valve, which plugs into the nearer valve-holder, has a special economiser circuit to reduce H.T. running costs.

* * *

The photograph to the right shows the all-important Contra-phase control, which shuts off the S.G.'s, H.T. and L.T. when they are not required. Above is a general impression of the set by our artist.

ACCESSORIES

LOUDSPEAKER: W.B., Celestion, Magnavox, Rola, B.T.-H., Epoch, Marconiphone, R. & A., H.M.V.

BATTERIES: H.T. 120 volts.: Siemens, Lissen, Ever Ready, Pertrix, Ediswan, Drydex, Marconiphone, Grosvenor, Hellesens, or Block H.T. accumulators.
G.B. 9 volts: Drydex, Siemens, Lissen, Ever Ready, Pertrix, Ediswan, Marconiphone, Grosvenor, Hellesens.
L.T. 2 volts: Block, Lissen, Pertrix, Ediswan, Exide, Oldham, G.E.C.

The diagrams of the above-baseboard and the below-baseboard wiring, already given, showed exactly where the components were placed relative to one another and how they were wired.

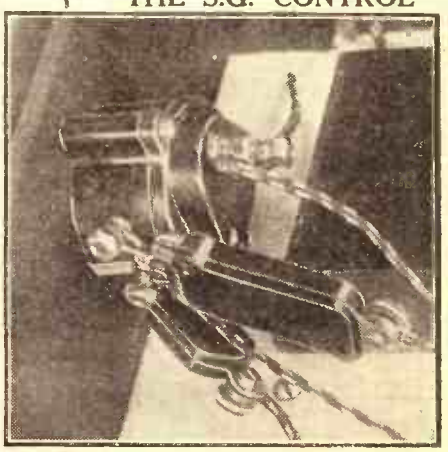
Most of our readers will have acquired such skill in set construction that everything will be perfectly clear to them. But the comparatively inexperienced may like to be reminded that each diagram carries a scale, and this enables any required measurement to be made without difficulty if a small rule is constructed to the scale and used to measure the diagrams.

Free From Complications.

As further photographs appear this week and the whole construction is really remarkably free from complications, even a totally inexperienced set builder need have no hesitation in undertaking the Contra-phase Four, provided he sticks to the components, etc., recommended.

The operation of the set, however, and the bagging of the countless programmes which it is capable of providing, necessarily call for further explanation, because the set is so fundamentally *different*. Its very simplicity is somewhat disconcerting!

THE S.G. CONTROL



Actually it is uncommonly easy to handle, and you will very quickly find out for yourself how responsive each control is and how beautifully the set "answers the helm," as it were.

But, to begin with, you must have a clear idea of exactly what is the function of each control knob. So we will consider them in turn and in detail.

(*Continued on next page.*)

THE CONTRA-PHASE 4

(Continued from previous page.)

Right in the centre of the panel is the single tuning control which operates the two-gang "·0005." When the set is operating as a four-valver both the ·0005-mfd. sections are in use. But when it is converted automatically into a three-valve receiver, by switching out the high-frequency amplifying stage (VI), only the nearer-panel section of the condenser is active.

The tuning is carried out exactly the same in both instances. But we mention this automatic cut-out of half the condenser because it explains why adjustments of the trimmer, provided at the back of the condenser assembly, can only be effective when the set is "four-valving."

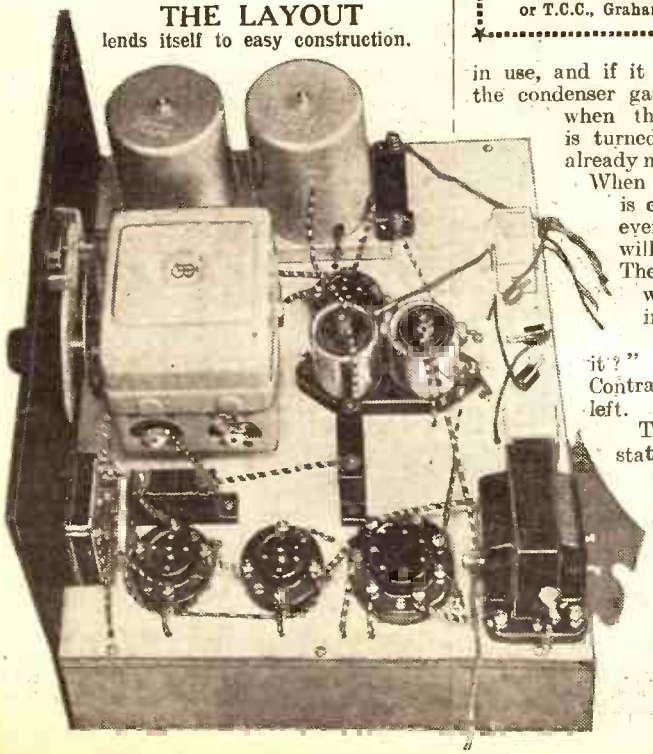
Changing from Two to Three Valves.

This change-over from three to four valves, and vice versa, as well as the control of volume, are all embodied in the adjusting knob immediately below the tuning control. It is marked "Volume Control and On-Off Switch" on the panel diagram, but, for simplicity's sake, we will now christen it the Contra-phase control.

The whole operation of the Contraphase principle depends upon the action of this volume control, so it plays a very important part in the set's working. All that we need notice about it at the moment, however, is that we shall call it henceforward the Contra-phase control; and it not only governs volume, but, in addition, it controls the automatic change-over from three to four valves, because it also switches the S.G. valve on or off.

THE LAYOUT

lends itself to easy construction.



Clips for the G.B. battery are fixed to the baseboard.

Apart from the tuning and Contraphase controls, there are just the two others on the panel. These are reaction (to the right) and (to the left) the set's on-off switch, which is of the combination type, permitting the wave-changing to be carried out as well.

All we need say about this latter control is that it is an ingenious and trouble-free component which combines the duties of the ordinary on-off switch and wave-change switch in the one instrument. Reaction, too, can be dismissed in a few words, it being a straightforward application of the usual differential principle.

The Condenser Trimming.

Now to consider the Contra-phase control. When this is turned full round in a clockwise direction it connects the aerial to the screened-grid valve's input.

In this position the set works as a four-valver and the volume is at a maximum. Both halves of the tuning condenser are in use, and if it is necessary to "trim" the condenser ganging this can be done when the Contra-phase control is turned fully to the right, as already mentioned.

When properly trimmed the set is extremely sensitive, and even the very distant stations will come in at fine volume. The local station, however, will then be overwhelmingly strong.

"What's to do about it?" Simply this: Turn the Contra-phase control full left.

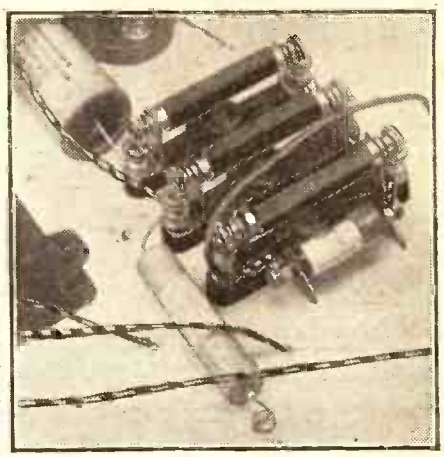
This will reduce the local station to the required lower volume. At the same time, and *quite automatically*, it will switch out the S G. valve and make the necessary change-over to the aerial connection to *convert the set into a three-valver.*

Intermediate Volume Levels.

As a matter of fact, you could, if you liked, take the H.T. + 1 lead right out of the battery without making the slightest difference to reception when the set is operating in this manner (with the Contra-phase control full left), for only the detector, driver and Class B valves are then operative.

In the intermediate positions of the Contra-phase control the S.G. valve is on, but intermediate volume levels are obtainable, thus enabling the set to cope with any desired strength of reception.

FOR SAVING H.T.



The "Westector" flexes the driver-valve's output to meet the strength of reception required. It is wired alongside one of the resistances.

COMPONENTS FOR THE CONTRA-PHASE

1 J. B. Unitune 2-gang ·0005-mfd. tuning condenser.
1 Lissen 2-gang coil unit with on-off switch, type L.N.5161.
3 W.B. small-type 4-pin valve holders, or Telsen, Benjamin, Lissen.
1 W.B. 7-pin valve holder, or Benjamin, Telsen, Lissen.
1 Telsen screened binocular H.F. choke, or Graham Farish.
1 Graham Farish screened H.F. choke, type H.M.S., or Bulgin, Telsen, Wearite.
1 Telsen ·0003-mfd. differential reaction condenser, or Graham Farish, B.R.G., Polar.
1 R.I. Hypermite L.F. transformer, or Varley, Lissen.
1 Igranic Class B driver transformer, or Varley, Ferranti, Lissen, R.I., B.R.G.
1 B.R.G. Class B outpnt choke, or Ferranti, R.I.
1 T.C.C. 2-mfd. fixed condenser, type 50, or Graham Farish.
1 Dubilier ·5-mfd. fixed condenser, type 4406, or T.C.C.
2 T.C.C. ·1-mfd. fixed condensers, type 250, or Dubilier.
1 Dubilier ·0002-mfd. fixed condenser, type 620, or T.C.C., Lissen, Graham Farish.
1 Dubilier ·0001-mfd. fixed condenser, type 620, or T.C.C., Graham Farish, Lissen.
1 Dubilier ·0001-mfd. fixed condenser, type 670.
1 Dubilier ·00005-mfd. fixed condenser, type 665, or T.C.C.
1 Graham Farish 100,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
1 Graham Farish 50,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
1 Graham Farish 200,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
1 Erie 30,000-ohm 1-watt type resistance with wire ends or terminals, or Dubilier, Graham Farish, Bulgin, Varley.
1 Lissen 2-meg. grid leak with wire ends, or Varley, Bulgin, Erie, Dubilier.
1 Westinghouse "Westector," type W.4.
1 Bulgin 50,000-ohm potentiometer with on-off switch, type V.S.36.
1 pair Bulgin grid-bias battery clips, type No. 1.
1 Peto-Scott panel, 12 in. × 8 in., or Goltone, Permcol.
1 Peto-Scott Metaplex chassis, 12 in. × 10 in. with 2½-in. runners.
1 Bulgin twin-plug strip, type P.30A.E.
2 Clix accumulator spades, or Belling Lee, Bulgin, Eelex.
5 Belling-Lee wander-plugs, or Clix, Bulgin, Eelex.
1 Belling-Lee fuse type wander-plug.
1 Belling-Lee anode connector, or Clix.
Flex, screws, etc. (Peto-Scott).

ALL ABOUT THE FOUR VALVES

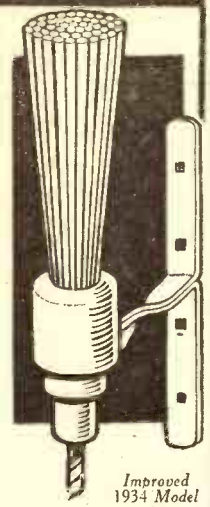
Make	S.G.	Detector	Driver	Class B Output
Cossor ..	220S.G.	210H.F.	220P.A.	—
Mullard ..	P.M.12A.	P.M.1H.L.	P.M.2A.	—
Mazda ..	S.G.215	H.L.2	P.220	—
Marconi ..	S.22	H.L.2	L.P.2	B.21
Osram ..	S.22	H.L.2	L.P.2	B.21
Hivac ..	S.G.220	H.210	—	—
Tungsram	S.220	H.R.210	—	—
Dario ..	T.B.422	T.B.282	T.B.122	—

SCRAP THOSE "DRUNKEN" POLES!

NO-MAST

THE WORLD'S BEST AERIAL

REQUIRES NO POLE



Improved 1934 Model

Only outdoor aerials give the best results. Follow the example of leading Radio experts and B.B.C. officials and install the "No-Mast" Aerial, which costs much less to buy and erect than the unsightly, troublesome pole aerial. The "No-Mast" Aerial is scientifically made, and **will definitely improve range, volume and selectivity.** A boon to flat-dwellers, enabling them to have an efficient outdoor aerial.

COUPON

To CENTRAL EQUIPMENT LIMITED, 188, LONDON ROAD, LIVERPOOL, 3.

Please send to my address :

1. **ONE NO-MAST AERIAL** (P.O. for 10/6 enclosed.)
2. **DESCRIPTIVE FOLDER** (Strike out item not required.)

NAME.....

ADDRESS.....

.....

P.W. 7/4/34. BLOCK CAPITALS, PLEASE

ENABLES YOU TO TUNE IN AND SEPARATE STATIONS NEVER HEARD BEFORE ON YOUR SET.

10/6
DELIVERED TO YOUR HOME
Complete with fittings.

A delightfully cool sweet smoke, burning free and evenly .... an Empire Blend of the highest quality.

PLAYER'S

AIRMAN

MIXTURE

10D PER OZ

ALSO AIRMAN NAVY CUT AND FLAKE. — 10°oz
NAVY CUT DE-LUXE 11°oz

P.A. 37-C.

RELIABILITY

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T.M.C. HYDRA Condensers are made in all standard capacities, with soldering tags or screw terminals at the same price.

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TESTED AND FOUND-?

Being Leaves from the Technical Editor's Notebook

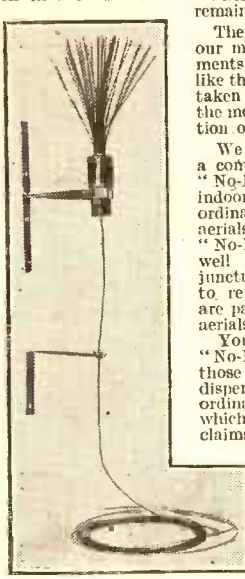
THE "NO-MAST" AERIAL

IT can be stated as a general rule that the most efficient aerial is one that is erected out of doors. And presumably this is widely known, for wherever there are a number of gardens to be seen there are all kinds of radio antenna to disfigure the scene.

Short masts, tall masts, thin masts, thick masts, and nearly all of them bent in the middle or leaning over!

And yet there is a quite inexpensive alternative which is neat and perfectly unobtrusive. I refer to the "No-Mast" Patent Aerial sold by Central Equipment, Ltd., 188, London Road, Liverpool.

It comprises a bracket fitting for fixing to the side of a chimney stack or to a wall. A substantial insulator carries a group of thick conductors. It is not necessary that these should be sprayed out, as shown in our photo, for the results differ very slightly in that condition from when they are allowed to remain tidily bunched.



Note the simple fixing of this efficient outdoor aerial. Two brackets only to fit.

They were separated in our model during our experiments and allowed to stay like that when the photo was taken in order to illustrate the more clearly the construction of the apparatus.

We conducted our tests on a comparative basis, and the "No-Mast" was tested both indoors and outdoors against ordinary indoor and outdoor aerials. In each case the "No-Mast" showed up very well indeed. And at this juncture it may be as well to remind you that there are patent aerials *and* patent aerials.

You must not confuse this "No-Mast" arrangement with those aerial devices which dispense entirely with any ordinary antenna and for which all kinds of extravagant claims are made.

The "No-Mast" definitely has an excellent "pick-up," and many who already have outdoor aerials should be able to turn to it with real advantage.

CLIX NINE-PIN VALVE HOLDERS

Eight years ago or so no valve had more than four pins. Then came the S.G. and others demanding five. Last year double-diode triodes and double-diode pentodes blossomed forth with seven pins. This year the number has been raised to nine!

And here let us hope it ends. You wouldn't have to take me back very many years to make me say that a nine-pin valve and a nine-pin valve holder could only result in very serious trouble.

But the modern valve is made within precision limits, and the spacing and pattern of the pins on the one does not vary a hairbreadth from any other. That is, among the well-known makes.

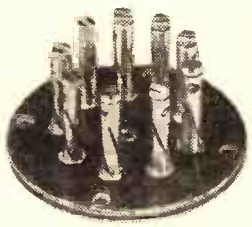
And there are valve holders to match them.

The new nine pins are already catered for by Messrs. Lectroliox Ltd., 79a, Rochester Row, London, S.W.1, and very well catered for, too.

Their "Clix" nine-pin valve holder is of the chassis-mounting type. Efficient contact is assured at each pin and the insertion and removal of the valve made smooth and easy by the adoption of a patent method of maintaining resilience in and at each pin. And to obtain such a completely successful result with nine pins is an achievement.

Despite the necessarily close grouping of the pins, the inter-pin capacity is quite negligible. Indeed, its low-loss character shows up many a four-pin holder!

There are terminals for the wiring, and these take the form of milled and slotted screws.



The necessarily close grouping of the pins in the Clix nine-pin valve holder has not given rise to any appreciable capacity. Wiring can be carried out quickly by means of the terminals provided.

PIFCO'S "ROTAMETER"

Meters are quite essential to the proper maintenance of a radio set, and the constructor, or even listener, who attempts to dispense with them works in the dark.

Obviously, H.T. and L.T. batteries require periodical testing in order to check their conditions, and it is vital that a G.B. battery should be tested at regular intervals, otherwise there may be an undue expenditure of H.T. or, perhaps, a more or less serious emission load on a valve that could do it irreparable harm.

Mains sets also demand "metering" if they are to be kept up to scratch. And in this case H.T. currents should be checked at intervals. In the case of definite faults arising, meters are indispensable. And often with their aid faults can quickly be found and expensive servicing and long programme delays avoided.

Very expensive instruments having laboratory degrees of precision are not required. On the other hand, moderate accuracy and complete reliability are essential.

In my opinion, these vital requirements are perfectly met by the new Pifco "Rotameter." This costs only 29s. 6d., complete with substantial leads, and yet it is eight meters in one.

The one compact device provides the following ranges:

(1) 0–8 volts for L.T. voltage tests. (2) 0–30 volts for testing grid-bias batteries. An extremely useful range this, and one that seldom figures on multi-range instruments. I presume we are usually supposed either to test the battery in sections (very tedious) or to rely on the H.T. range (and seriously restrict the checking). Pifco are to be complimented on this innovation alone, for G.B. testing is, as I have already indicated, probably the most important test of all.

(3) 0–250 volts for H.T. tests. (4) This is another original and most valuable voltage range by which the small battery enclosed within the instrument can be tested at any time merely by turning the range-control knob.

It has always seemed to me a weak point in the ordinary multi-range instrument that its own battery has to be taken out and tested.

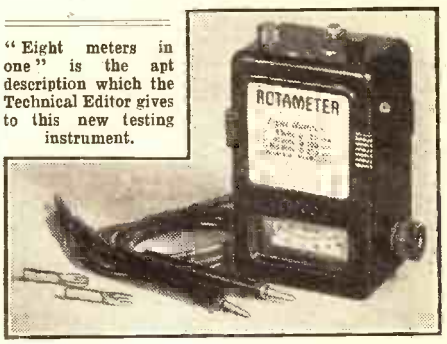
(5) 0–20 milliamperes for individual valve tests, etc. (6) 0–100 m/a. for testing total H.T.'s. (7) 0–250 m/a. ditto. (8) This is a useful 4,000-ohm filament, resistance and general continuity test range.

Now, you do not have to dig out all these ranges from one scale having on it a multiplicity of figures. The little knob on the side which enables you to switch from one range to another also completely changes the dial.

So really this wonderful "Rotameter" is the perfect electrical chameleon. When, for example, you turn the knob to "30 volts" the instrument is then, from all outward appearances, as well as in its internal arrangements, a 30-volt voltmeter, and it could not possibly be confused with anything else.

Likewise, if the knob is turned to "20 m/a.," you then have a milliammeter reading to 20 milliamperes, not an obvious adaptation.

The "Rotameter" incorporates a fuse as a safeguard against careless handling, and it is beautifully made. Its needle gives a dead-beat action and close response on all its ranges.



"Eight meters in one" is the apt description which the Technical Editor gives to this new testing instrument.

All who are interested—and I believe that must be every owner of radio equipment—should at least write to the makers, Provincial Incandescent Fittings Co., Ltd. of Pifco House, High Street, Manchester, for "Rotameter" literature.

Jottings of Interest to Buyers.

By G. T. KELSEY.

IT'S a very far cry from the first Cossor "Melody Maker," with its bulky solenoidal coil (remember it?), to the one which has just been produced. But in the years which have elapsed since that old favourite first made its appearance the fame and prestige of Cossor's famous "Melody Maker" series of constructor kits have become world-wide, and it is a safe conjecture that the latest one, to be known as the Model 340, is destined to be a winner, too.

Cossor's are always so very thorough about everything they tackle. I speak from experience, for my associations with this enterprising radio firm go back many years, and I recall with pleasure several happy hours spent within the precincts of their vast technical laboratories. They always used to remind me of a sort of technician's conception of Paradise, and whenever I got inside I used to experience the greatest difficulty in dragging myself away. That was seven or eight years ago, and, bearing in mind the tremendous strides that have been made since then, I am afraid that if I went into their labs. to-day I should find so much to interest me that I should never want to come out!

The Latest Melody Maker.

It is my recollection of the many "rabbits" that have been brought out of the Cossor laboratory "hat" that gives me the confidence to speak so very highly of this their latest effort, for it was in these same labs. that the latest "Melody Maker" was born. It's true that I have not yet had an opportunity of testing it; but, knowing Cossor's products, I have no fear of the issue.

This latest model, which is for battery operation, is similar in general appearance

(*Continued on page* 98.)

The WAVELENGTH PROBLEM in TELEVISION

by G. P. Kendall B.Sc.

THERE would seem to be a good deal of misapprehension about the real meaning of the wavelength problem in television, and this is only natural if one goes by the "explanations" in the daily Press, from which it would appear that certain special waves have been found to give *inherently better results*, for some mysterious reason not specified!

It is decidedly important to get to the bottom of the question if one hopes to understand future developments, so I propose to go into it with some thoroughness this week.

The general principles are not at all difficult to follow, because there is a perfectly logical basis for the whole thing: it is nothing to do with certain special waves possessing strange properties which cause them to carry the picture better than others!

Short waves have been hailed as a heal-all for television troubles, but this article contains a timely warning on the subject. It also explains exactly why ultra-short waves have been favoured by televisionaries—a topic of special interest in view of the B.B.C.'s recent experiments from the aerials on Broadcasting House, London.

Not Merely Due to Wavelength.

I must make this very clear, and I think the following practical illustration will help. Suppose that the apparatus now used by the B.B.C. for the normal television service were to be connected up to a short-wave transmitter instead of one working on the broadcast band, so that the picture was radiated on, say, ten metres.

Should we get any better results at the receiving end? Most certainly we should not, and we should find it difficult to prevent them from being slightly worse, as a consequence of the greater difficulty of making correct adjustments in the receiver.

Of course, I am assuming here that the modulation circuits of the short-wave transmitter would be similar to those of the ordinary broadcast-wave station.

The whole point is simply this: on any given wavelength there is a practical limit to the fineness of picture detail which it is feasible to transmit, and this limit gets wider and wider as the wavelength grows shorter. Consequently, on a really short wave it is possible to use television apparatus designed to take advantage of the fact, the real difference thus being more in the television gear than the radio.

A Matter of Detail.

Let us see if we can get a clear idea as to how this comes about. It is all based on the fact that the fineness of detail in the picture settles the range of frequencies which the radio transmitter is called upon to handle.

If we want very good detail our transmitter must deal with extremely high frequencies, and that is where the difficulty comes in on the ordinary broadcast wave-band.

On these waves stations may not transmit frequencies higher than 9,000 cycles per second, lest they cause interference with others on near-by waves. This state of affairs is really a consequence of the chronic overcrowding on these waves, for if we could devote almost the whole range to one television transmitter the ban could be lifted, and although there would be certain practical difficulties it would be possible to transmit pictures in much finer detail.

On the short waves conditions are very different, for here we are dealing with enormously high frequencies, and a range up to even 50,000 cycles in the modulation frequency represents only a very small percentage difference in the frequency of the carrier-wave. Just what this means in terms of practical tuning problems we shall see as we go farther into the question.

To get a preliminary idea let us see what the modulation frequency is in terms of the carrier frequency if the wavelength is ten metres: this wave is equivalent to a frequency of 30,000,000 cycles per second, and a modulation frequency of 50,000 is only about ·166 per cent of this figure!

Now let us see what amount of "spread" we should get in this case. It will be enough for our purpose if we calculate it in just one direction, so let us see how far *downwards* the interference will spread.

Plenty of Room for Stations.

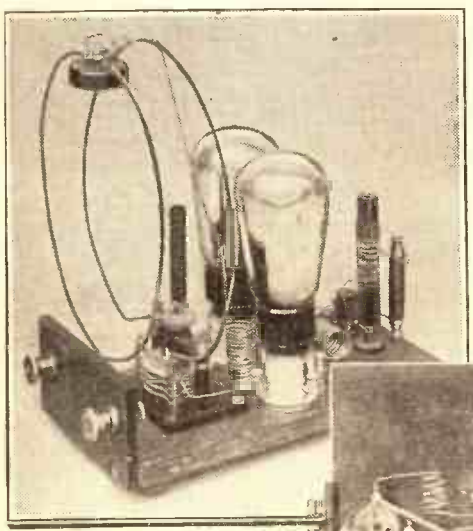
On working it out we find that it extends as far as a wavelength of 9·983 metres, so it is evident that quite a number of high-quality television transmissions could be accommodated between, say, 7 and 10 metres.

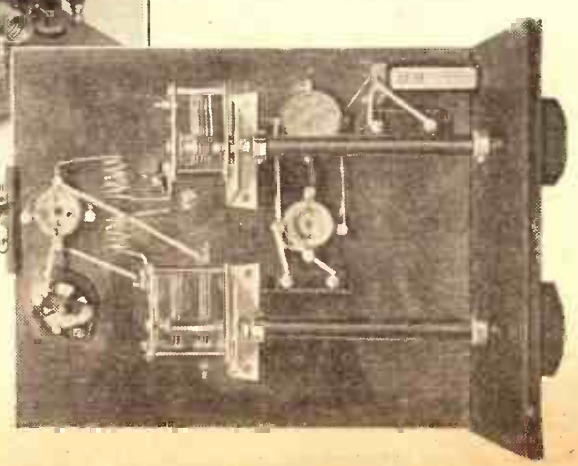
The actual results which can be obtained with a frequency range extending up to 50,000 would be decidedly good. Just how good they would be is very difficult to explain in words; but we shall get some idea if we remember that this is more than five times the modulation range permissible with the present transmission, so that theoretically we should expect accurate reproduction of details at least five times as fine as those we now see.

The figure of 50,000 for the limit of modulation frequency is just one which I have taken for purposes of explanation, by the way. Even higher frequencies than this have been used in short-wave experiments, both in this country and abroad.

Probably we shall get a clearer conception of the improvement possible on short waves if we think in terms of the greater number of scanning lines which could be used. This, of course, is the factor which settles the range of the modulation frequencies, a high scanning frequency calling for a proportionately wide range.

(*Continued on page* 98.)





THOSE ULTRA-SHORTS

These photos of apparatus used on the ultra-short wavelengths show that it differs widely from ordinary receiving gear, as Mr. Kendall points out, especially the very long extension handles in the receiver (to the right), these being necessary to minimise hand-capacity effects.

All About Pentodes

Continuing our special series for beginners, pentodes, peak voltages, parasitics and permeability, are among the radio terms clearly explained

by G. V. Dowding
Associate I.E.E.

OSCILLATOR.

Apparatus for producing oscillations. Similarly, an oscillator valve is a valve employed for the purpose of producing continuous oscillations.

PARASITICS.

A term often applied to atmospherics, but also used as an abbreviation of "Parasitic Oscillations" (Parasitics).

Parasitic oscillations are spurious oscillations generated in an amplifier. They used to be frequently encountered in neutralised circuits, and are now sometimes evinced in Class B amplifiers.

The usual cure is to introduce series resistance in order to damp them down.

PEAK VOLTAGE.

The maximum voltage reached by an alternating current.

It is vital that any components used in a circuit in which there is an alternating current should be designed to withstand the peak and not just the average value.

Although A.C. mains may be rated at, say, 250 volts, at every half-cycle the voltage will rise to approximately 357 volts, and it is this voltage which represents the "working" voltage a condenser, for example, should be able to stand up against.

TONE CORRECTION

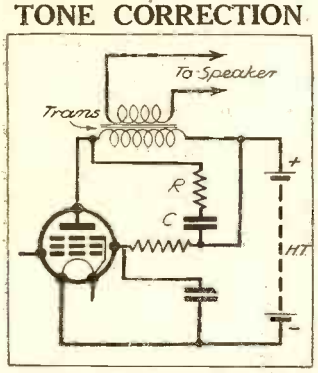


Fig. 1.—This diagram is identical with Fig. 3. except that a tone corrector (consisting of a resistance R and condenser C in series) is joined across the primary of the output transformer.

To estimate a peak voltage, divide the effective (R.M.S.) voltage by seven and multiply this result by ten.

PENTODE.

This is a valve in which there are three grids, in addition to the anode and filament. The diagram of Fig. 2 illustrates the positions occupied in the valve by these various electrodes.

As will be observed, the grid nearest the filament is the control grid, and the task this performs is similar to the grid in a three-electrode valve, i.e. to enable the input energy to control the electron stream and so cause anode-current fluctuations.

The screen grid comes next, and this is given a positive potential slightly less than that of the anode.

The purpose of this scheme is to enable a higher external resistance to be employed (anode impedance), across which greater voltages are developed and thus a higher amplification obtained.

In the case of the ordinary triode a limiting factor on amplification is the variation of effective voltage on the anode due to voltages set up across the anode impedance—the windings of a loudspeaker, for example. The anode current is stabilised by the screen grid, which in effect provides a fillip for the electrons on their way to the anode.

In the H.F. pentode the screen grid also has the job of reducing the anode-grid capacity.

The third grid is known as the suppressor grid, and is placed between the screen grid and anode. It is joined internally to the filament or cathode.

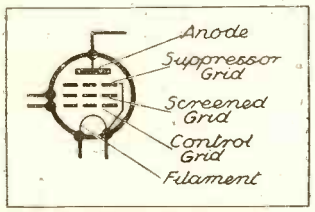


Fig. 2.—Showing the three grids of a pentode and how they are arranged inside the bulb.

Secondary Emission.

The suppressor grid eliminates secondary emission effects. Secondary emission is caused by the electrons from the filament striking the anode, from the metal of which electrons are released by the collision.

These electrons would, were the suppressor grid not there, tend to go to the screen grid and oppose the electron stream and reduce the anode current, so that at certain anode voltages there would be an actual reduction of anode current for anode voltage increases.

The suppressor grid turns these anode-emitted electrons back to the anode, but does not impede to any extent the electrons arriving from the filament, for these are given fresh impetus by the screen-grid.

The L.F. pentode which is used in the output stage of a set needs special "matching." The transformer or choke suitable for the anode circuit of an ordinary power valve has not a sufficiently high impedance.

As the screen grid operates at a slightly lower voltage than the anode it can be connected to the H.T. by a small dropping resistance, see Fig. 3 and Fig. 4. A fixed condenser is needed to "decouple" this electrode.

High-Note Response.

Pentodes tend to give prominent treatment to the high notes. This is sometimes an advantage, and provides compensation for high-note reduction due to peak tuning, reaction, etc.

If, however, the high-note, exaggeration is still too great a simple tone corrector will equalise the response. For instance, a resistance and condenser in series can be joined across the anode choke or the primary of the transformer, if one is used. (Fig. 1).

Average values for these are ·01 mfd. and 15,000 ohms.

The H.F. type of pentode is made in variable-mu form. That is, its control grid is so fashioned that varying a negative grid bias on it varies the amplifying power of the valve.

Another use for the H.F. pentode is as a combined oscillator and detector (mixer) in a super-heterodyne circuit.

When gauging the H.T. current taken by any pentode it should be remembered that a certain amount of current flows around the circuit comprising the screen-grid H.T. battery and filament. This must be added to the anode current, for it often amounts to three or four milliamperes.

FULLY DECOUPLED

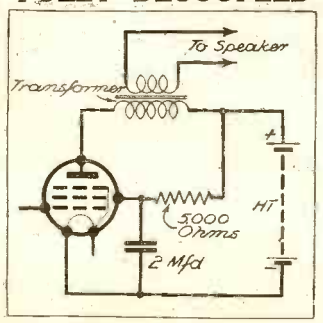


Fig. 3.—In this case the voltage from the maximum tapping of the H.T. battery is taken to the screened grid through a 5,000-ohm dropping resistance, a 2-mfd. condenser being used for decoupling.

PERMANENT MAGNET.

A magnet which retains its magnetism for an indefinite time after being initially magnetised. Steel in one form or another is employed for permanent magnets, and in moving-coil loudspeakers special cobalt steels are generally used.

A great amount of research has been applied to the development of these cobalt steels for the magnetic systems of loudpeakers, the object being to obtain the greatest magnetic intensity with a given mass of metal.

PERMEABILITY.

The conductivity of a material to magnetic lines of force. It can be compared with conductance in current electricity. Air and other substances that are electrical insulators have a permeability of unity.

Permeability is an important factor in the design of L.F. chokes and transformers. Obviously the greater the permeability of the core of for example, an L.F. transformer the greater will be the concentration of the lines of force, with a consequently greater inductance for a given number of turns of wire.

A LOWER VOLTAGE

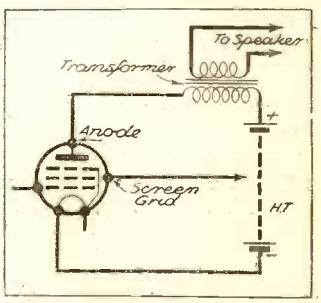


Fig. 4.—The screened grid is given a positive potential slightly less than that of the anode.

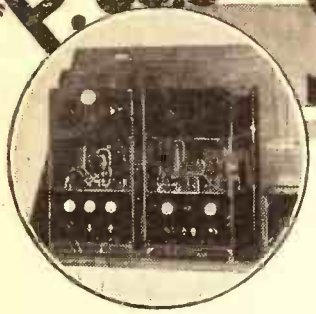
PHOTO-ELECTRIC CELL.

A kind of valve for transforming light into electrical current. It consists of a glass bulb from which the air has been extracted (and which sometimes is filled with an inert gas) and a cathode and anode.

The cathode is the active electrode, and is usually of silver or copper coated with a thin film of cæsium or rubidium. When light falls on the cathode, electrons are released from it and thus current flows.

Photo-electric cells have many applications. They are used in television, talking pictures, alarms, indicators and in many different scientific instruments.

"P.W.'s" Show Station



In 1932, visitors to the "Popular Wireless" stand at Radiolympia examined with immense interest the complete short-wave transmitting and receiving station which was on view. This station now has a permanent home at the Science Museum in London as typical of modern amateur broadcasting.

IN the Nov. 18th, 1933 issue of POPULAR WIRELESS there was described "An All-band Short-wave Receiver" which formed part of a complete amateur transmitting station lent to the Science Museum in London by POPULAR WIRELESS. In the article it was mentioned that it might be possible later to give a full description of the station.

Readers who visited the 1932 Radio Exhibition at Olympia will no doubt remember seeing the outfit on the "P.W." stand, and it was on account of the large amount of interest which it attracted that it was eventually decided to lend it to the Science Museum at South Kensington.

A Crystal Controlled Transmitter.

In the accompanying photograph you see the station as it appears in the Museum. It was specially taken by the authorities so that readers could see it as it appears "in real life." As I mentioned just now, the outfit is a complete transmitting and receiving station. It is designed for operation on the 150–170-metre amateur band, and the transmitter, which is crystal controlled, can be set to work anywhere within this band by the use of a suitable crystal. The receiver is rather more flexible, for it covers all wavelengths between 16 and 200 metres. Altogether, an equipment that would delight the heart of many short-wave enthusiasts.

The transmitter comprises the two units, or frames, on the extreme left of the picture. The one nearer the end of the desk contains the crystal-controlled oscillator and radio-frequency power amplifier, while the other houses the modulator section.

The crystal oscillator works at the fundamental frequency, and the crystal that was actually used in the transmitter is ground for 170 metres. The valve, which is of the small-power type—with an indirectly-heated filament—has about 200 volts on the anode.

The H.F. Amplifier.

The power input to this valve is of the order of 5-6 watts, and its anode current is read on the right-hand meter of the three. In order to increase the power output of the transmitter the oscillator is followed by a radio-frequency power amplifier. This valve is also of the ordinary power type, but is, of course, somewhat larger than the crystal-controlled oscillator.

The input to this valve is normally of the order of 10 watts, but if necessary it can be pushed up to about double this figure. The anode voltage is rather low for transmitting purposes, being in the neighbourhood of 250 volts, but this is necessitated in order to get the right ratio of anode current to anode voltage for optimum results on telephony.

The tuning controls are located on the upper panel, as is also the aerial current ammeter. Note the tuning coil in the upper part of the frame.

When it is desired to use the transmitter for telephony it is necessary to modulate the carrier-wave. This is done with the aid of the unit contained in the second frame. It is really a large low-frequency power amplifier, capable of considerable output. This amplifier consists of a first and second stage of L.F. amplification, and finally a large-power valve which, instead of supplying a loudspeaker, feeds into the transmitter proper and so modulates the carrier-wave.

Interesting Modulator Section.

The modulator section of a transmitter is in many respects very interesting, for it has to be capable of handling a large amount of power and is nearly always larger than the transmitter itself. In order to modulate fully a 10-watt carrier it is desirable to have a valve in the modulator section capable of supplying at least 5 watts of undistorted power, which would mean, normally, a dissipation of something like 25 watts.

The one being described, however, is somewhat larger than this. The valve will supply 20 watts of undistorted power, sufficient to modulate a 20-watt carrier-wave. This leaves plenty of power in hand, but does not require an exceptionally high anode voltage.

Returning to the photograph on this page, the power unit for the modulator is located behind the bottom panel. It consists of a 550-0-550-volt transformer with two half-wave rectifying valves. The left-hand meter on the panel indicates the anode current taken by the modulator valve, while the other one shows the amount of current taken by the microphone.

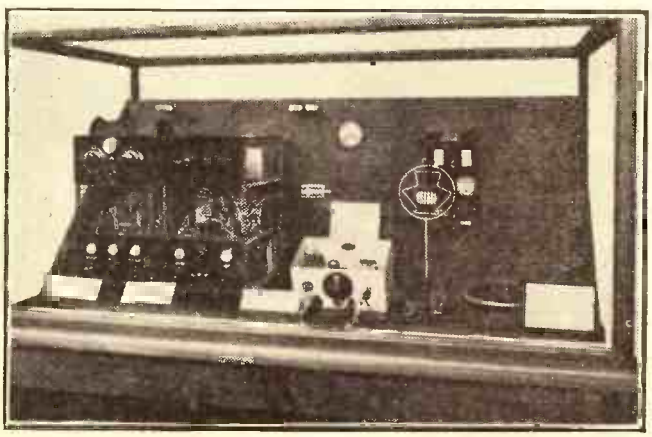
Microphone or Pick-up.

The input of the modulator can be changed over to either microphone or pick-up by means of a switch below the right-hand meter. The volume control is situated in the centre of the middle of the panel, while two switches below are used to turn on the high- and low-tension supplies respectively.

The electric turntable and pick-up can be seen on the extreme right, with the microphone slightly to the left. Behind the microphone is the main switchboard, from which the various parts of the apparatus can be controlled.

Another interesting feature of the station is the electric clock. This is of the synchronous type, and in these days of time-controlled supplies these clocks can be relied upon to keep excellent time.

AS IT LOOKS TO VISITORS



Here is the complete station as assembled at the Museum in its glass case. The various portions of the apparatus are described on this page.

Simple Receiver.

The receiver has already been described, but for those who did not read the article it is a simple two-valve affair employing a detector and one stage of low-frequency amplification. The various wavebands are covered by means of interchangeable coils, and the whole set is contained in a specially designed metal cabinet.

Parallel-fed transformer coupling is utilised, and a jack is provided to take the plug attached to the telephone leads and to switch the set on.

All those readers who are interested should make a point of going along to the Science Museum to see the station. It is situated in the main hall of the Wireless Section, together with a number of other interesting exhibits, and if at any time you have an afternoon to spare you could have a very interesting few hours making a tour of inspection.

F. B.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

TWO DIAL TUNING.

A. E. E. (Chester-le-Street).—"The old set had just the two dials, tuning and reaction. And I had got thoroughly used to handling these, so I never lacked a good supply of foreigners when I got down to it.

"I do not keep a regular log of programmes received, like some people, but I will swear I must have had over fifty different stations—at various times, of course, not all in one sitting.

"Now the trouble is that the new set has *three* dials—1st tuning, 2nd tuning and reaction. But I have still only got *two* hands. So I get a bit tied up with it.

"The instructions say, 'Keep the two tuning dials in step, and reaction will seldom be necessary.' All very fine, but what exactly is this 'in-step' business?

"And then, again, small knobs don't help. They evidently think the reaction won't be used much, as they have given me a dial on it which is only about one-third of the size of the tuning knobs. Wouldn't it be better to have a bigger one fitted?

"My feeling is that the set is a far better one than the old one, but I don't seem to be working it right. The quality is just grand. And what foreigners I do manage to get come in with as much of a thump as North Regional or National. But there are too many tuning knobs for my liking.

"So if you can put me wise like when I first had the other one I reckon I shall be the envy of the neighbours yet."

There is a world of difference between handling one of the single-tuned-circuit receivers (like your old set) and one which has two separate tuning dials as well as reaction. And this difference lies in the relative importance of the reaction control.

We are speaking, of course, of long-distance reception particularly; and it is safe to say that thousands of two-tuning-circuit sets fail to give the good results of which they are capable because their owners fail to tune them properly.

With any set which does *not* employ an S.G. valve the great idea is to tune with one hand and keep the reaction closely supporting the tuning with the other hand. That was what you did with the old set.

But when there is an S.G. stage between the aerial and detector the two *tuning* dials are the important ones, and the reaction has to take a back seat.

Instead of having to nurse the set and keep its reaction close to the oscillation point, the great thing is to get both tuning dials correctly set. Most of the time the reaction can be left at minimum.

So to search for distant stations with a set of your present type you should operate normally with one hand on each tuning dial. Whilst the first condenser reading is *slowly* increased with the left hand, the right hand turns the second tuning condenser backwards and forwards a little at successive dial positions; this keeps the second dial-reading at somewhere about the same value as the first dial-reading.

But whereas the first (left) hand turns *continuously* upwards, the second (right) hand is more active, and keeps dodging back and forward a little way to make sure nothing has been missed; though its general tendency is to keep pace with the left-hand dial as this progresses from the bottom to the top of the range. (Or vice versa, if you are tuning down, from top to bottom of the dial.)

(If that seems a bit complicated, read it again with the set in front of you. It is really simple enough, but naturally there is much more difficulty in setting it out word by word than in actually doing it.)

As soon as an unfamiliar station is heard the left-hand dial settles on the position where the programme was picked up, and *stays there*. The right-hand dial hovers, as usual, for a moment on the similar and adjacent-dial readings, until the two dial-readings "come into step." There will be no doubt about it when this happens, because at just that one particular adjustment a very marked increase in volume is noticeable.

Having got the two tuning dials in step in this way, you can then bring up the strength still farther by reaction if this is necessary. But you will find that very often the mere act of getting the tuning dials in step is quite sufficient, reaction being a sort of luxury you can keep in the background.

SCREENED H.F. LEADS

FOR BETTER RADIO

To ensure stability and freedom from feed-back it is often essential to use screened wire for certain leads, and metal-covered wire of the type shown is frequently employed for the purpose.

* * *

For this covering to act efficiently as a screen it should be earthed; so, when cutting the lead, it may be advisable not to cut the covering also, but to use this as the earthing connection and join it to the nearest earthed point, as shown.

The best way is to get the hang of the thing without touching reaction at all at first, and only bring this into play when you are satisfied that both your tuning dials are correctly set. You will be surprised at what a set, properly handled in this way, can do to the foreigners.

As regards the small size of the reaction dial—well, you can now see why the manufacturers generally fail to give this a big adjusting knob. It is hardly necessary.

But if you are going in for a lot of long-distance reception there is some advantage in easier reaction control, and a bigger knob is certainly a help.

Before you make the change, however, try out the foregoing method of tuning. You may decide that it gives you all you want without bothering about the very fine adjustment of reaction.

A MYSTERY LONG-WAVER?

We have received several inquiries on the above subject, of which the following extract from a letter from Mr. H. M. Wood, of "Clyde," 83, Junction Road, Andover, is typical

So far we have been unable to trace the transmission definitely, but perhaps some of our readers will recognise it.

In his letter to the Editor, Mr. Wood says:

"I was searching the long waveband at about 8.15 p.m. on Friday, March 9th, when, at about 850–900 metres (the tuning of this station was so flat that it is difficult to give its wavelength accurately), I heard a man's voice in German. After a short time a woman spoke to him, he answered, and another man also appeared to be joining in the conversation. These were obviously not all in the same room, but were communicating with each other telephonically. During lulls in the conversation queer sounds similar to the dialling of a number on an automatic telephone could be heard.

"Frequently the name 'Bremen' could be heard, though whether this referred to the ship of that name or not I could not say.

"The quality was poor and fading was bad, but the signals occasionally came in very loudly.

"It appeared to be two-way telephony on a single wavelength, as occasionally one voice appeared to fade more than the others.

"I should be extremely obliged to anybody who may be able to give me any information, and it may also interest other readers to see if they can find this.

("May I, in writing, express my appreciation of the 'Manual of Modern Radio,' a truly useful and well-written book?)"

SIMPLE H.F. DECOUPLING.

C. M. W. (Leicester).—"I think it (the 'National Eckersley Three') is going to prove a 'wow,' but at the moment I am troubled by a sort of whistle, which may be due to my having altered the layout slightly.

"I am using KGO and KGR coils, but the L.F. layout is exactly as described, so I cannot see why I should get an L.F. howl."

In certain circumstances it may be found that the set, when using KGO, KGO and KGR coils, gives indications of what appears to be L.F. instability, i.e. a high-pitched howl.

This trouble can easily be remedied by decoupling the anode circuit of the H.F. valve. For this you require an additional 5,000-ohms resistance complete with holder, which may be a Graham Farish Ohmite, Ferranti Synthetic or similar.

This should be mounted on the underside of the chassis.

The wiring should then be as follows, 2 of the KGR coil connected to one terminal of the ·25-mfd. fixed condenser and also to one terminal of the additional 5,000-ohms fixed resistance.

The other terminal of the ·25-mfd. fixed condenser remains connected to the metallised chassis. The remaining terminal of the additional 5,000-ohms resistance should be connected to the terminal (nearer panel) of the original 5,000-ohms resistance.

It should be noted that the lead which previously connected the terminal of the original 5,000-ohms resistance (terminal nearer panel) to 2 on the KGR coil should be removed.

FITTING A VARIABLE-MU S.G. VALVE BIAS CONTROL.

R. E. (Fazeley).—"I thought that my old S.G. had found the secret of perpetual life, but at last I have seen signs of senility, the milliammeter proving that anode current is now below par when all the voltages are correct. So I am going to scrap the valve and get a V.S.G. in place of it.

"Over a year ago I had the change-over all schemed out, and I kept by me a 50,000-ohms potentiometer, ready for use. But that old valve has held on to life so long that I have lost the diagram of connections!

"Will you therefore check up this arrangement, which looks O.K. to me? But I may have remembered something wrongly or forgotten something.

"At present the lead from the aerial coil unit and fixed vanes of first condenser goes direct to the G terminal of the S.G. holder. I propose to break this lead and put in a ·0003-mfd. (tubular) condenser.

"Then, from that side of the new condenser which will be joined to the G terminal, I propose to run a very short lead to one side of a

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

grid-leak clip, in which is placed a 1·0 meg. leak. The other end of this clip is very close to the volume control, to enable another short lead to run from it to the slider terminal on the volume control.

"This leaves the two outer terminals of the control to be dealt with, and one I am sure goes to the negative plug for the S.G.'s grid-bias battery. But the other (+) lead from this battery I am not quite sure about, as I think it did not go to the L.T.— on account of a 3-point switch (on-off) being advised.

"Also where does the H.T. neg. lead go? And the other lead from the 50,000-ohms potentiometer? (The present (2-point) L.T. on-off is in the L.T. positive lead.)"

If a 3-point on-off switch is used—and it is certainly an advantage, as it prevents the possibility of wrong connections allowing the battery to run down when the variable-mu valve is unused—the + lead from the variable-mu's grid-bias battery should be taken to one of the points on the on-off switch; this same point also being connected to the negative of the H.T. battery, which is thus disconnected from the L.T. when the switch is in the "off" position.

The other two points on the on-off switch are then used as before, one of them going only to the L.T. battery — and the other to the negative side of the various valve holders, etc.

And, finally, the remaining outer terminal of the 50,000-ohms potentiometer should be joined to the negative filament wiring of the S.G. valve, which will make your proposed connections O.K.

SHUNT-FEEDING THE LOUDSPEAKER'S TRANSFORMER.

W. N. (Cardiff).—"Left over from one of my earlier adventures in wireless I had an output transformer which I used successfully with my first loud-speaker. It was in good condition when I discarded it, and still appears to be perfect mechanically.

"The reason I put it aside was that with a super-power type of valve it seemed to overload, though it was all right on a smaller valve.

"Recently, as an experiment, I tried out the old loudspeaker again as an addition to the M.C. speaker arrangement now in regular use, which operates from a tapped choke in a pentode's plate circuit. This has two 2-mfd. condensers, one in each lead from the M.C. speaker to the tapped choke.

"It occurred to me that if I joined up the primary of the old transformer between earth and the loudspeaker side of the 2-mfd. condenser which is connected to the plate of the pentode, I could utilise this condenser as a filter condenser.

"It works fine, and I get far better volume on the old speaker than I was ever able to get before.

"Would the better results be caused by my present connections diverting the plate current from the primary of the old transformer, whereas before the current was passed through it?"

Yes, this would certainly tend to improve results, but other factors may be helping as well, as there is a wide difference in your operating conditions now that a pentode is used as an output valve.

CRYSTAL SET THAT WORKS LOUDSPEAKER.

In response to many inquiries we would advise readers that so far we are unable to supply particulars of the crystal set to which reference was made in "Radiotorial" of our March 17th number. It will be remembered we published a request from a South African reader of "P.W." who appealed to another reader—F. W. W. of Woodford Green—for details of the circuit he uses.

Up to the time of writing F. W. W. has not replied to us, but he may have done so direct to Cape Town (as the address of our South African correspondent was given in full). If we receive the details we shall be pleased to give them for the benefit of all interested readers.

THE LISTENER'S NOTEBOOK

(Continued from page 82.)

fails to have these, then we shall continue to compare it with the stage play to its own detriment.

* * *

A newcomer to me in variety is Bern Ecks. I like his act, because I can honestly laugh at him. A crazy comic with more than a spice of originality is our Bern.

* * *

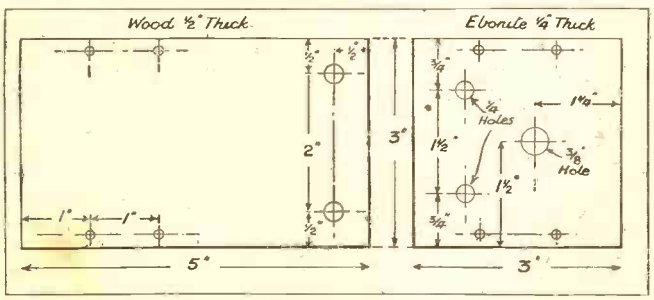
Mr. Beverley Nichols may sound a little monotonous on the air, but he fairly makes you sit up and take notice. It was something of a novelty to hear a layman talk at length on such a topic as the need for more church-going. He spoke on other things as well, and in everything he said there was food for thought. He seemed to anticipate a certain amount of opposition to his remarks, but I wouldn't be surprised if actually he was generally well received.

* * *

Two outside broadcasts, both of a sporting nature, in one afternoon, make us forget our grouses against the B.B.C. And when they are well done, as the Boat Race and the International Rugger match were, we want to shout, "For They Are Jolly Good Fellows," and forget the censorship.

C. B.

A NOVEL PICK-UP ADAPTOR



This shows how to drill the wooden top and the small ebonite panel of the novel Pick-up Adaptor which is described on page 79 this week. The panel holds the volume control and terminals.

TEN THOUSAND LETTERS!

(Continued from page 83.)

plays seem to meet with approval, and I have been particularly gratified to find my own contention that "effects" should be used as sparingly as possible is also the opinion of the greater number of my correspondents.

To sum up from the particular point of view of the Drama Department, this experiment of making contact with our unseen audience has been a startling success. Whether it is possible to extend such an experiment to other fields of broadcasting is quite another story.

The audience for radio plays is, to some extent, a specialised audience and is likely to remain so; but to all those who have co-operated so gallantly in making that experiment a success I should like once more to express my thankfulness. The feeling of working in an unresponsive void has been finally and triumphantly dispelled.

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NAME.....

ADDRESS.....

Pr.W., 7/4/34.

THE LINK BETWEEN

(*Continued from page* 92.)

to those of the 1933-34 team. It has variable-mu screened grid and detector stages, with a Cossor 220P in the output position. I believe I am correct in saying that this particular output valve is capable of giving an output adequate in all respects for normal domestic requirements.

It is supplied with a fine modern cabinet, and, in addition to the salient feature of economy in operation, the design permits of the use of a gramophone pick-up. The price, which includes cabinet, loud-speaker and, of course, the set, is £5 7s. 6d., and convenient hire-purchase terms are available.

Full details of this fine kit are available, free of charge, to "P.W." readers through the medium of our postcard literature service. Just send the usual postcard to me at Tallis House, and I shall be pleased to make the necessary arrangements. **(No. 80)**

* * *

Ekco to the Fore Again.

So many new sets have been released by the commercial-set manufacturers generally during the last month or two that I begin to wonder how long it will be before my friends, the listening public, become thoroughly "spoilt for choice," to use a North Countryism.

The trouble is that all these new sets reach such a high standard of performance that it becomes increasingly difficult to single out any particular one on the score of merit alone. Prices, too, are all highly competitive.

Even so, there is always room for something new when Ekco is behind it, for this enterprising firm seems to have acquired the happy knack of providing just that touch of distinction. Remember that remarkable tuning dial of theirs, and subsequently the outstanding black and chromium effort?

That they worthily uphold their traditions in the design of the model that has just been released is obvious even from my cursory examination of the technical specification and a photograph. It's an all-electric radiogram with practically every modern refinement, and it is to sell at the extremely modest price of 21 guineas, complete.

The new Ekco radiogram is housed in a most attractive cabinet, which is modern without having too much of the futuristic touch about it.

Readers will, no doubt, be interested to learn that "P.W." has made special arrangements for a complete test report to appear in this journal at an early date.

* * *

Here and There.

Microphones at prices to suit all are featured in a catalogue which is available free on request to all "P.W." readers. Address your applications to Messrs. Electradix Radios, Electradix House, 218, Upper Thames Street, London, E.C.4, and it will help if you mention POPULAR WIRELESS.

OUR POSTCARD SERVICE

Application for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way — just quote the number or numbers.

I am always glad to be able to pass on news of price reductions. I learn with interest that the Drydex battery type H.2000 has recently been reduced from 10s. 6d. to 7s. 6d. Stuff to give 'em!

* * *

Another commendable move in the war on "man-made static." Messrs. Ward & Goldstone have recently marketed a new device known as a "Statoformer" which has every appearance of being a great step forward. Users of "Statoformers" can avail themselves of the services of a special department which has been established by W. & G. to deal with all aspects of the interference problem. An ambitious effort on which I congratulate them.

Substantial price reductions are the chief features of a new catalogue of accumulators and dry batteries which has just been released by the Fuller Accumulator Co. (1926), Ltd. It is available free for the asking through the medium of our postcard literature service. **(No. 81)**

THE WAVELENGTH PROBLEM IN TELEVISION

(*Continued from page* 93.)

The picture which we now see is scanned in only 30 lines, and the process is repeated but 12½ times per second. On a wave of 7 metres successful tests have been made under laboratory conditions in Germany with a picture of 120 lines and a picture frequency of 25 per second!

This last point is an important one, for, although the higher picture frequency does not affect the amount of detail, it does remove the flicker seen at the 12½ rate and eliminates jumpiness from the motion of rapidly moving objects in the picture.

Tests have been made in England at 180 lines, and the picture rate has varied from 12½ to 25. Experiments on similar numbers of scanning lines are still proceeding in this country, and I even hear rumours of some extremely hush-hush work on much higher frequencies still.

Whether these extremely high rates of scanning are justified in the present state of development of receiving gear is perhaps a little doubtful, but it all indicates the direction in which television research is moving, and it was to enable the reader to follow this research with understanding that I have written this article.

AN INTERESTING DEMONSTRATION

Last year the historic "Popular Wireless" ultra-short-wave tests proved the value of the Crystal Palace Tower as a transmitting site. Since then continuous research has been carried out there by Baird Television Ltd., resulting in the success described below.

I WAS recently afforded an opportunity of seeing a demonstration of the results which can be obtained from the high-definition television transmissions now being made from the Crystal Palace by the Baird organisation, and those results interested me so much that I think some account of them should be given to the readers of "P.W."

The transmissions use a wave of 6 metres for the picture and another of 6¼ metres for speech and music, and the demonstration took place at the Gaumont-British premises in Wardour Street, where radio conditions might be expected to be extremely bad.

Nevertheless, the first thing which struck me was the real excellence of the sound transmission. The signal was absolutely steady, there was very little extraneous noise and the actual reproduction was remarkably good.

The picture was reproduced by means of a new giant-size cathode-ray tube, which is apparently free from the unnatural coloration which was so noticeable in the earlier types. In front of the tube a large lens was placed, giving the effect of a picture about a foot across, so that it could be seen by nearly fifty people.

The fineness of detail seen in the picture was truly remarkable, the faint-line pattern on a performer's soft collar being clearly visible, for example. In general quality the effect was very similar to that of a photograph of the soft-gradation type, and it was pleasant to note how the familiar flicker had almost completely vanished as a result of the increased picture frequency of 25 per second.

A Problem for Designers.

The picture is scanned in no less than 180 *horizontal* lines, and this, in conjunction with the high-picture frequency, involves modulation frequencies up to a million cycles per second. Truly a problem for the designer of amplifiers!

The general amount of detail struck me as completely acceptable, and such criticisms as I should offer would be based only on the rather unnatural effect of the almost direct frontal lighting employed on the faces of those at the transmitter, the presence of faint dark lines across the picture at times and a curious "waving-in-the-breeze" effect seen quite often in any well-defined lines near the edges of the picture.

G. P. K.

THE "VOL-PEN" TWO-VALVER

Another reader pays tribute to the excellence of "P.W." design.

The Editor, "POPULAR WIRELESS."

Dear Sir,—I have taken "P.W." for several years and have built many of the sets described, but I feel I must write and thank you for the "Vol-Pen" 2 in No. 602, which I completed a week ago.

Last summer I built a really good mains unit, and have been using a directly-heated mains pentode with an ordinary battery set. This was a bit complicated, and when I saw the "Vol-Pen" 2 described I decided to go all-mains, and I am very pleased with the result. At first I got rather a large hum from the detector (the set is dead quiet on gramophone), but by altering the circuit connections of the L.F. transformer according to Fig. 258 in the "Manual of Modern Radio" I have reduced it to almost nothing.

I can get at least a dozen continental stations at more than comfortable strength, while the volume from the North Regional and National can be tremendous without any distortion being present.

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TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Removing a Broken Needle.

WITH reference to the curious fault I mentioned in these notes last week, many of you may have wondered how we removed the broken needle from the pick-up. It was at once evident that this offending piece of broken *steel* needle was not going to come out by just shaking the pick-up, because, of course, there was a very strong magnetic attraction to keep it there.

Well, we all scratched our heads and eventually decided that we would *never* get it out unless we could remove it from the influence of the permanent magnet of the pick-up. Fortunately, the pick-up was of a type in which the coil assembly could be fairly easily removed, and when we got this away from the magnet we were able to knock out the offending piece of steel needle quite easily. It turned out to be a broken piece about $\frac{3}{16}$ inch long, so you can guess that it was stopping the needles from going in quite a bit, and that was what accounted for the " reedy " tone.

When the pick-up was all assembled together again it gave perfect reproduction without a trace of the previous rattle.

Repairing Pick-up Coils.

Incidentally, in the process of shifting the coil we managed to break one of the fine wire leads and had quite a nice little job soldering it on again. In case you ever have the misfortune to break one of the leads inside the pick-up I should mention that this wire is often of as fine a gauge as 48, and as it is enamelled you have to remove the enamel before you can solder the wire to a thicker lead.

It is little use trying to scrape off the enamel with a penknife, because, in the first place, you can scarcely see the wire, and, in the second place, you are practically certain to sever it with the blade. About the only thing to do is to lay it on a piece of wood and then rub it longitudinally with very fine sandpaper, the finer the better.

In this way you can get the enamel off, and when you look at the wire in a certain light you will see the glint of the copper. It should then be very carefully wound several times around the thicker lead so that it cannot come away, and then soldered with a fairly hot iron, which must, by the way, be very clean.

Reaction Peculiarities.

I do not know whether you have noticed that with a set employing reaction you will sometimes find that a station which is brought in with a good deal of reaction does not remain so steady in volume as one which requires little or no reaction.

The reason for this is that the detector does not give an output signal strength proportional to that supplied to it; in fact, the strength of the output is more nearly proportional to the square of the input. You will easily see, then, that if the input is doubled the output becomes four times as great; if the input is trebled the output is nine times, and so on. I do not say that it is in this exact ratio, but it is generally in a greater ratio than merely proportional.

You will see from this that if a station is tuned in and a good deal of reaction is used in the process, then a slight variation in the strength of the incoming signal on the aerial will produce a relatively large variation in the volume of the output; whereas in the case of another station which is tuned in without any reaction at all the variation of the volume will be more nearly proportional to the variation of the incoming signal. In other words, the use of reaction makes the volume proportional to a higher power of the input.

This is only one of various reasons why you should always tune in a station with as little reliance upon reaction as possible.

The Uniformity of Metal Valves.

The new metal valves which are now firmly establishing themselves in popular favour have advantages apart from the mere advantages of their construction.

One of these, which I do not think has been sufficiently emphasised, is the uniformity that they tend to give as compared with ordinary glass valves. You know that in designing a set the designer has to bear in mind the variation which will be met with by the use in the set of different valves, these variations amounting to as much as 10 or even 20 per cent.

If he designs the set for what you might call the minimum efficiency of the valves, then when somebody goes and uses a set of selected, very efficient valves, the receiver will probably become unstable, all of which is very difficult and very confusing for the designer.

Bringing Standardisation Much Nearer.

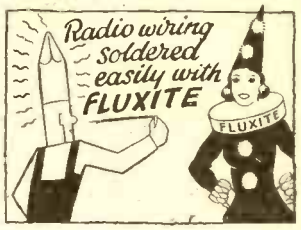
If, on the other hand, valves could be made so nearly uniform that the variations in their efficiency and characteristics amounted to only a very few per cent, then the designer could go all out and give you practically the full efficiency of the circuit, whatever it might be, knowing that on the one hand you would not be likely to run into instability by a set of super-efficient valves, and on the other hand that you would not be disappointed by happening to get a set of poor ones.

Valve manufacturers have done wonders in the last two or three years to make their valves more uniform, but this is still one of the difficult points about valve manufacture, and it seems to me that the new metal valves bring this standardisation very much nearer.

Quiescent Push-Pull.

A lot of people do not know that although it is desirable to have special components for quiescent push-pull amplification, or push-push, as it is sometimes called, nevertheless you can often get quite good results with ordinary push-pull components. Naturally, you cannot expect to get quite the same results as if you use the proper components,

(*Continued on next page.*)



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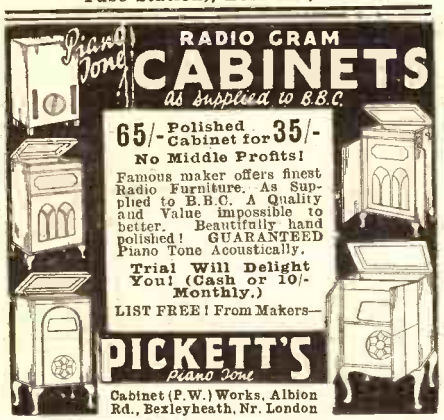
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TECHNICAL NOTES

(Continued from previous page.)

but, as I say, you may with care get a good approximation.

For one thing, you will bear in mind that the input transformer for push-push may have a ratio of as much as 8 to 1, or even more, whilst the ordinary push-pull input transformer has a ratio of perhaps only 2½ or 3 to 1. Another point is that the chokes and transformers used for push-pull output are usually intended for ordinary three-electrode valves, and this rather precludes you from using pentodes with them. But if you use, say, small power valves you will quite likely get reasonably good results, provided that you can go to a voltage of 120 or more on the anodes, whilst the grid bias is adjusted so as to bring the current down to a couple of milliamps each.

Push-Pull Components.

As you know, the essential principle of the quiescent push-pull is to make the anode current vary with the strength of the incoming signal, so that, when there is no signal coming in, the anode current is not more than perhaps 4 milliamps for the two valves, whilst, when the signals start coming in, the anode current jumps about accordingly.

Using a Meter in the Anode Circuit.

Incidentally, if you use a milliammeter in the plate circuit you will get some very interesting results, and you will have to put out of your head any idea of judging distortion by the kicking of the milliammeter needle, as you do in the ordinary way. If you judged by the needle only you would get the impression that the reproduction must be truly appalling; but, as I say, the behaviour of the anode current with this push-push arrangement is totally different from that with the ordinary circuit, and the "carrying on" of the needle of the milliammeter in the anode circuit gives totally different indications in the two cases.

Choosing a Set.

I am always being asked about the choice of a radio set. I expect a good many of you have the same experience, so I'm sure you will sympathise with me when I say that there are few questions more awkward to answer. So much depends on so many different things.

First of all you ask: "Do you want only B.B.C. stations or are you anxious to receive a lot of foreigners as well?" Probably this brings the admission: "I really don't know. I'd like to get anything that's good." Rarely do you meet anyone who knows just what is wanted. It is all left so delightfully to *you*.

The question of battery or mains operation is usually fairly straightforward, because anybody who has electric light knows that it is much more convenient to use it instead of batteries. (Incidentally, I know a lot of people who have electric light and still use batteries—and without a trickle-charger at that.)

The Question of Quality and Volume.

Then you come to the point about quality and volume. Theoretically, everyone desires quality rather than quantity, but give them quality *without* quantity and they'll plump for quantity every time.

The choice of a loudspeaker opens up a vast field for speculation. "I'd like one of those with a nice mellow tone." Unfortunately, what *you* think a nice mellow tone and what somebody else thinks it is are often two very different things.

The most you can do is to give an account of the merits and capabilities of the different types of receivers, and then leave the choice to the other side.

In this catalogue of points you must not forget price, size, portability, ease of working, mains or battery operation, sensitivity and selectivity, aerial and earth requirements, number of valves and question of maintenance, volume, tone control and so on.

Portability.

With regard to portability, you should bear in mind that if a set is going to be really portable—I don't mean semi-portable or transportable—it must economise in size and weight of components. With coils, transformers and so on, since these have been so much improved of late, this is not a serious matter.

But when it comes to batteries and loudspeakers—I am assuming batteries, if it is a really portable set—then the cutting down of size may well cramp its style a bit.

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As regards the loudspeaker, most people will favour a good moving-coil type. Personally, I have a preference for the moving coil with separately excited field winding, and in a commercially built all-mains set this will generally be provided for.

But if you are making up a set yourself you may not want to be troubled with provision for the field current, in which case you can choose one of the excellent permanent-magnet moving-coil speakers on the market. Some people have a fancy for moving-*iron* speakers and there is a great deal to be said for these.

They have been so very much improved of late that I know a number of people who will back their fancy in this direction even against a good moving-coil speaker. Certainly a *good* inductor or balanced-armature speaker is preferable to an indifferent moving coil.

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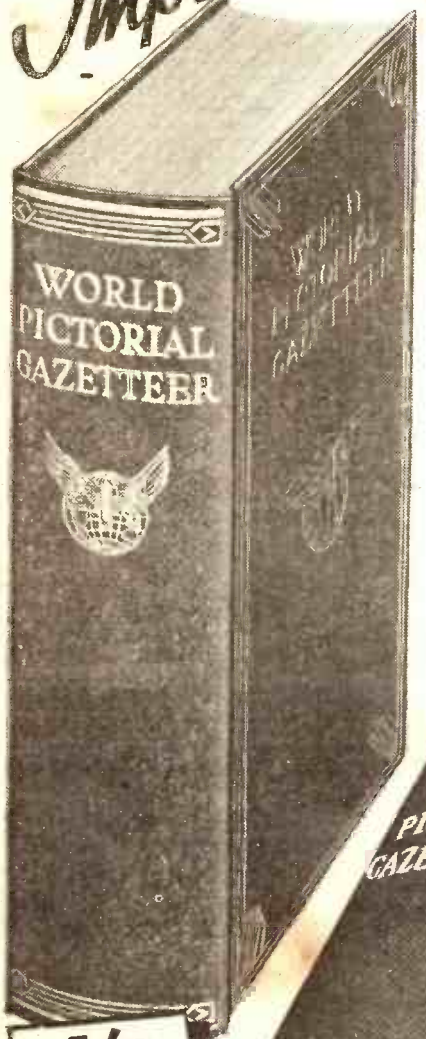

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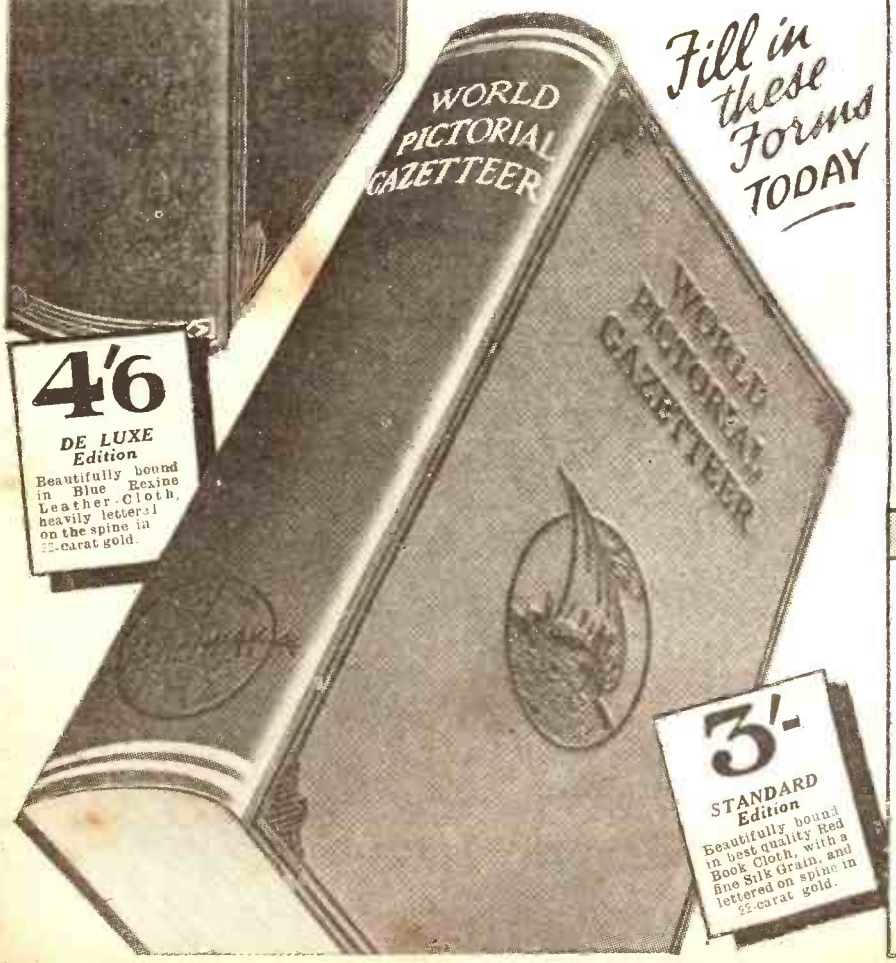

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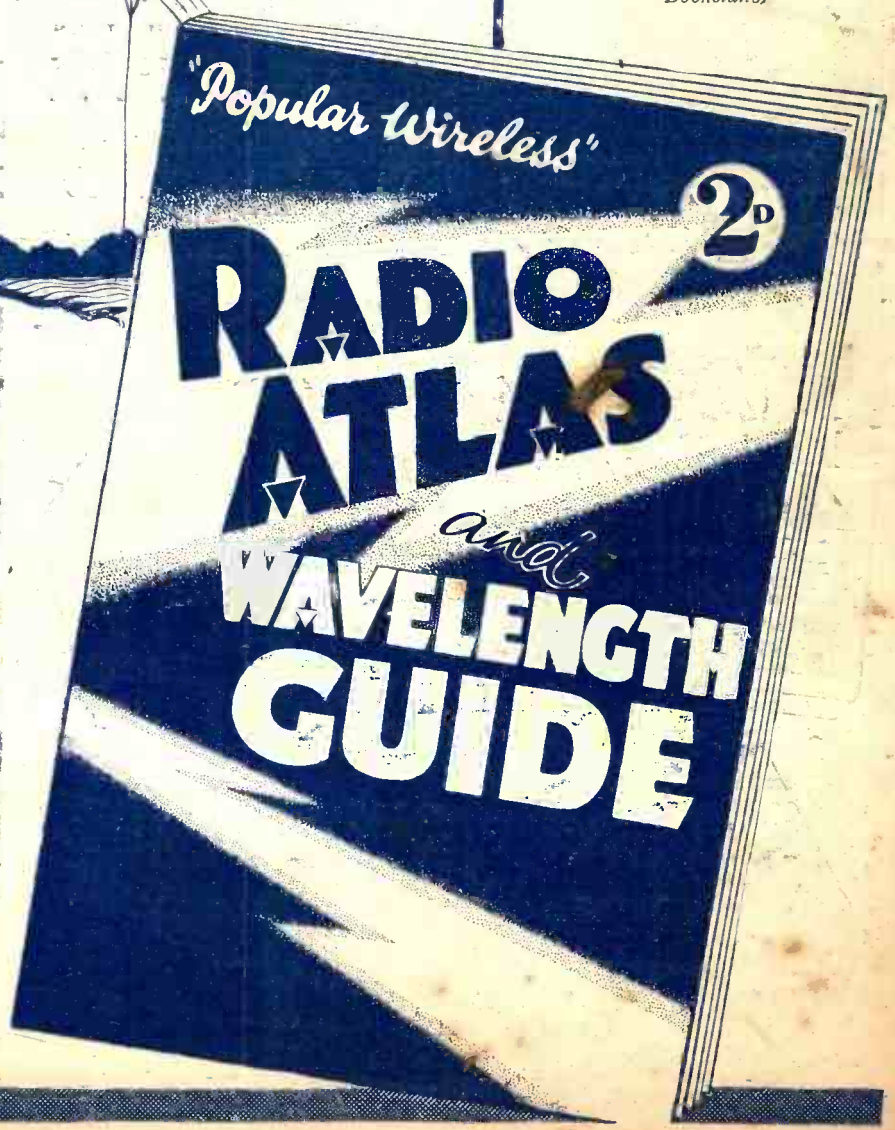

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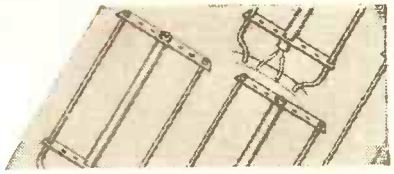

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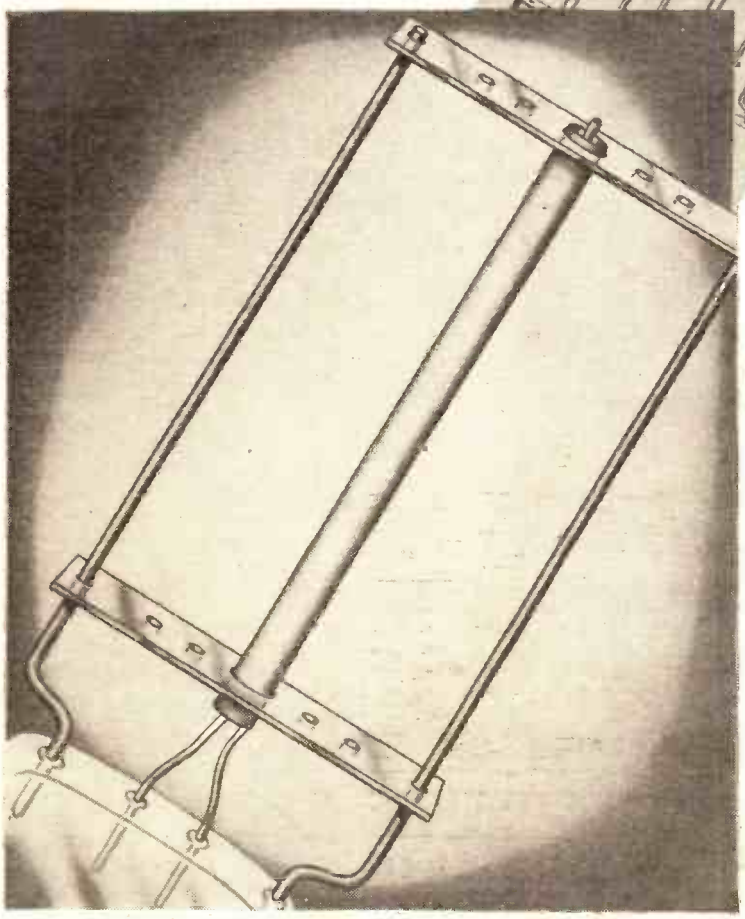

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RADIO WEATHER
CLUB NOTES

RADIO NOTES & NEWS

LIVE AND LEARN
"NIGHT AND DAY"
TRUE TO LIFE
B.B.C.'s BURGLARS

Life Is So Full.

I MUST confess that I sympathise with the Scottish parson who expressed his fear that if the meenistry interfered much more with his golf he would be forced to give up the meenistry.

For with the cubbig of sprig the claims upon my leisure time, such as it is, become insupportable. There is the garden, a whole-time job for one pair of hands and one set of lumbar muscles; and there is taking Arieline for lovely walks in the gloaming; and there is going to watch the Arielette play tennis.

Hi! Where do I get a minute for radio revels?

The Search Magnificent.

BEFORE leaving the domestic scene I invite you to compare notes with me over last Sunday's affair *chez* Ariel. (All the best columnists use *chez.*)

Well, the music stopped suddenly, and I said that the B.B.C. had broken down. After a time I became less confident and twiddled the knobs, only to find that, with all the volume control out, the signals were normal. One valve gone? Bad connection?

I dived into the set and made exhaustive tests, drawing blank. Then, as I dived yet deeper, the Arielette, who was at the window to watch an aeroplane, remarked: "There's a long piece of wire dangling over the lawn." Down-lead had come adrift from lead-in tube. G-r-r!

Proper Precautions.

THE wave of criticism of the B.B.C.'s internal organisation which swept over some portions of the Press early in March contained much which gave me a pain in the neck. Nothing was too trivial for comment.

One point in particular struck me as singularly short sighted, and that was the complaint that artistes are asked to wait until their bona fides have been checked before they are escorted to the studios.

Considering what mischief could be perpetrated by an interloper with evil designs, I think that the B.B.C. is fully justified in exercising the greatest caution.

Done on One Valve.

REFERRING to a Roche reader's toot about his one-valve and thirty stations, as I thought I should, so I indeed have received competing claims. W. L. E. (Woking), using a "W. L. S. Short-Wave One," has picked up and held W C A U. His aerial was an indoor "sausage."

W. L. E., by the way, finds that "atmospherics" are nearly always stronger during full-moon period, and prefers a fortnight later. This is not in accord with other observers.

Personally, I think that the moon does not come into the picture at all. Don't all write at once, though; slay me piecemeal.

Keeping It In the Family.

THE Hubbard Gold Medal for outstanding geographic achievement has been awarded to Mrs. Lindbergh, the wife of the flying colonel of that name, for her work as wireless operator, aerial navigator and co-pilot on the flight which she and her husband made last summer. I believe it was the flight for surveying a route for the proposed North Atlantic air service.

She is the first woman to receive this medal, and has now drawn level with the colonel, who already has it. Three cheers for a gallant little lady!

Blame the Wireless Waves.

HOW hard the "radio-makes-the-weather" theories die! The discussion is still raging, ding-dong, in a West Country paper, wherein a true believer gives his opinion that, with every advance in the power of radio stations, cloud formations become increasingly electrical.

This same seeker after truth writes: "There is a North Magnetic Pole. How is it, then, that, with the continued increase in wireless, the winds should be persistently northerly for the last 12 months?"

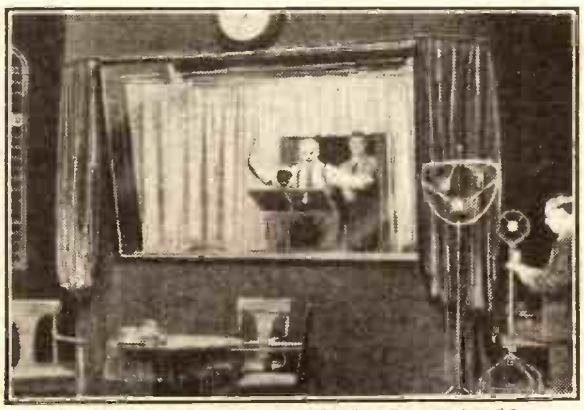
That's an easy one. If we didn't have a North Magnetic Pole *all* the winds would be southerly and the fur trade would be a perfect flop. But without a north there could be no south, and so the whole darned compass would be upset because of radio.

Another Radio Club Under Way.

THE Glasgow and District Radio Club advises me that the response to my note about its formation was "good." It has now grown up, has held its fourth meeting and is a going concern. Fine!

But more members are needed, and anyone in Glasgow who is inclined to take Ariel's advice to join a radio club should write, enclosing a stamped and addressed envelope, to the Secretary, Mr. H. Duff, 90, Budhill Avenue, Shettleston, Glasgow, E.2.

UNDER LISTENING CONDITIONS



A new photograph from Budapest showing the sound-proof conductor's cabinet (at the end of the concert studio), in which the musical director listens to the orchestra through a loudspeaker while conducting via the glass window.

Women Announcers.

WHEN Miss E. L. Sprott, of the B.B.C., stated that Mrs. Borrett was removed from her job as announcess because so many women wrote objecting to one of their own sex, she revealed that the B.B.C. is capable of being influenced by correspondence: though it may be, of course, that they were not really convinced, but preferred Mrs. Borrett's absence to an intolerable flux of heavily underlined female squawks.

I see no more reason why a woman should not be an announcess—provided her voice is suitable—than that a man named Gurples should not be a railway porter.

But, it is to be observed, the B.B.C. did not try again.

(*Continued on next page.*)

PLAYING FIVE THOUSAND RECORDS!

We Live and Learn.

I HAD always thought that church bells were rung by strenuous people dangling on the ends of long ropes; but an announcement made in connection with a proposed broadcast of the carillon of St. Patrick's Roman Catholic Cathedral, Armagh, has added to my knowledge.

It seems that there are things called "notes" which have to be struck very forcibly with the side of the hand. The carilloneur wears pads on his hands to protect them from bruising.

I should hate to be a hasty-tempered carilloneur's little boy!

A New DX Club.

A NEW international organisation, the Universal DX Radio Club, has come into being. Its headquarters are at 2559, Polk Street, San Francisco, U.S.A., to which all inquiries should be addressed.

I can tell you now, however, that the subscription is 1 dollar 20 cents for the first year and 85 cents per year thereafter.

By the way, Mr. Leslie W. Orton, of the A.-A. R. and T. Society, is an Hon. Vice-President of this club, but inquiries should not be made to him, but to 'Frisco.

The Trip Wasn't Wasted.

MY story about the highly paid engineer who made a journey of 125 miles by sea in order to "vet" a wireless station, only to find two telephone tags not connected to the receiver, is ably capped by D. B. K. (Sydney, N.S.W.), who tells how, ten years ago, he was sent from London to near Aberdeen on a "servicing" job which actually amounted to no more than the replacement of one burnt-out valve.

But his host kept him there for a whole week for shooting, fishing and, I have reason to believe, elbow lifting. What a complacent employer was D. B. K.'s, though!

Much in Little.

R. H. (Fulwood).—In order to save currency difficulties for a fellow-fan, perhaps you would send copy, anyway. Address is E. Björkmann, c/o Tollpost A.S. Oslo, Norway.

S. S. F. (Exeter).—Yes, I *am* sincere in my notes about the value of radio clubs—and your local club is ready for you to test the matter.

L. A. (Homerton).—Doubt whether the fitting of a directional aerial worth trouble and expense.

K. P. R. (Dundee).—This is not a "film" paper, and I don't know Greta's address. (Come, come!) Ask Marlene.

Better Late than Never.

TO congratulate the B.B.C. for its abolition of the "ghost-in-goloshes" interval signal might smack of sarcasm, considering that the change has been so long on the way, despite our frantic beckonings.

How on earth it was compassed one cannot imagine. Consider the committees, reports, memoranda, etc.! One hopes that nobody resigned rather than withdraw Standing Order X—Z/CQ 6349!

However, now that reason has prevailed we may rejoice in a signal worthy of the status of British broadasting.

This Science is Dreadful.

MY son and heir is supposed to be learning chemistry, and he is very profound when speaking of acids. During the "hols" he alarms his ma with home-constructed explosives — which never do what they ought—and annoys the kitchen by purloining all the available pots and bottles.

He has recently been investigating my battery, and the other day he approached me and uttered these words, like an accuser: "That acid contains decimal thirty-five per cent of 2FePRQX"—or some such gibberish.

ON THE AIR THIS WEEK:

Claude Hulbert (*National, April 12th*).

Part author of "Postman's Knock," in the revival of which he will appear this week. Started life unluckily, being born on Christmas Day, so that he only gets one set of presents for the two celebrations! The son of a doctor, learnt how to act at Cambridge. Has broadcast regularly since 1928 as himself, as a quarter of "Those Four Chaps" and with his wife, Enid Trevor. Once inherited £14,000. Likes home life and pictures (moving) and lives in Chelsea.

Ever since then my set has kicked over the traces, the morning milk has been stolen and the spare bedroom's ceiling has had a damp patch.

"Night and Day."

THE 1934 catalogue of H.M.V. records is an astonishing production of 400 pages, covering some 5,000 records. Some painstaking computator connected with the Gramophone Company has declared that it would take five weeks, playing day and night, to reproduce them. Perhaps some scientist with a passion for checking facts would care to try the matter out in practice.

And which do you think is the most popular of these records? Handel's "Largo," of which there are fifteen different recordings.

Can Any Club Help?

HERE'S a chance for some radio club to oblige another overseas and to gratify the writer of these notes.

The Radio Society of East Africa, having been presented with a silver cup to be awarded to the competitor who makes the best S.W. receiver up to three valves, asks whether we can give details of any similar competition held in the U.K. which would serve as a basis in framing the rules of its competition.

I should like to help these exiles, so will anyone who can provide the required information kindly write to me, c/o The Editor?

How True to Life!

MR. C. C. PATERSON, O.B.E., in delivering the Faraday Lecture at the Institution of Electrical Engineers on March 15th—and how I wish you could have heard it!—spoke of the travel of electrons: how, when moving, they have a wave character and, when colliding, a particle character.

And, *inter alia*, he made this pregnant remark: "So long as any travelling thing has not arrived it has only a probability of arriving." Our office-boy—to the life! "But once it gets there, there is no longer any probability about its being there; its presence is a fact."

Yes, and he demonstrates it by whistling "Riding on a Rainbow"!

Groucho in a New Rôle.

GROUCHO, of the famous Marx Brothers, agrees with Eddie Cantor about the undesirability of studio audiences, and is equally funny in his remarks on the subject. He says that it is hard for him to work in front of an audience which has not paid to get in!

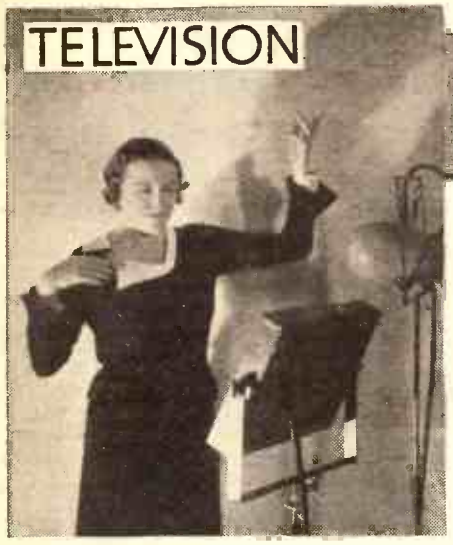
"When we were on the stage," he adds, "for years we were used to working without an audience for our shows, and we don't like to break down a tradition." Besides, he says that he is uncomfortable in front of a studio audience, and so is the audience, and their discomfort invariably increases his, and so he is in favour of preventing all that discomfort!

Preparing to Repel Boarders.

THAT'S what the landlady's Irish stew does, too. I refer, however, to the B.B.C.'s latest *coup de something or other*, no less than the fitting of Broadcasting House with burglar-proof shutters. Somebody has (a) been trying to abduct the Controller of Output or (b) trying to set light to ten tons five kilogrammes three gills (North Country size) of hitherto absolutely unused Foundations of Music.

But—to revert to my customary seriousness—what has the B.B.C. worth sneaking other than the petty cash and the stamp box? I know! It must be the scores of "Wozzeck"!

ARIEL.



A Problem of Progress

By C. P. KENDALL B.Sc.

I HAVE devoted a good deal of space recently in this series to considerations of the likely future development of television, and we have seen that the most noteworthy tendency to-day is in the direction of more finely scanned pictures, permitted by the exploitation of shorter wavelengths for transmission.

How long it will be before there is anything in the nature of a regular service of this type for public use it is hard to predict, and it is open to doubt whether those who are experimenting on the ultra-short waves are not off on the wrong tack: such waves present very great difficulty from the point of view of general use by the non-technical public.

One of the drawbacks to progress in television development is the fact that new inventions or methods are liable to cause the experimenter's apparatus to become out of date almost as soon as it is bought! So, in this practical article, Mr. Kendall deals with adaptations to television gear due to better scanning methods at the transmitting end.

It appears possible, however, that some sort of compromise wave will be found which will permit considerably improved pictures to be transmitted without making the problem of reception too difficult. It therefore seems time to review the question from the practical point of view and see what would have to be done in order to take advantage of such a transmission, if and when it materialises.

The Type of Set Needed.

First of all, of course, we should have to provide ourselves with a short-wave set designed for the best results on the particular wave ultimately chosen, but that is not a matter which will present any special difficulty to the reader of "P.W." No doubt the Research Department will have the necessary practical design all ready when the time comes.

It is interesting to note, however, that such a design will most probably differ somewhat from the conventional short-waver intended for the reception of Morse and telephony. It will require to be laid out with very great care to ensure proper reproduction of the very high modulation frequencies which will characterise the fine-detail transmissions of the future.

In all probability it will be difficult to make very full use of reaction without some loss of detail, and I think this is likely to lead to more determined attempts to exploit H.F. amplifying methods if the wave is not too ultra-short.

Detection methods will almost certainly need to come under review for the same reason, and here the lessons of the high-quality broadcast receiver will no doubt be applied. Some form of modified power-grid rectification will very possibly be found helpful, while the anode circuit of the detector will also require some general cleaning-up, the problem here being to exclude H.F. currents from the low-frequency amplifying circuits without by-passing the higher modulation frequencies.

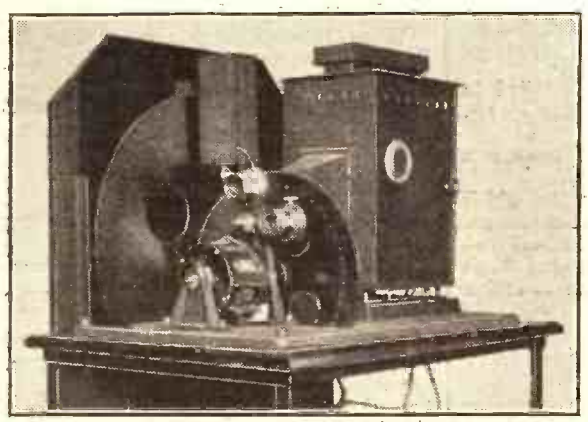
Low-Frequency Considerations.

The low-frequency amplifying side of the receiver will also need a deal of care, for it will have to cope successfully with a range of frequencies extending far beyond the usual audio limits. To me it seems certain that we shall be driven to the use of resistance-coupled amplifiers, and even these will call for some skill in design.

These, however, are not things which will cause much concern to the hardened radio enthusiast, for he has seen much more difficult problems come and go in the past. They are all amenable to treatment by known methods, and I doubt if they will give us much real trouble.

The question of the necessary adaptation of existing television gear is a little less easy, and I think it is here that the reader will be glad of some definite information.

Naturally, the steps to be taken will depend entirely upon the nature of the scanning and synchronising apparatus used in any given receiver, so we must consider the various types separately. The simplest type, using a neon tube and a disc, will call for the more severe overhaul, and it will be found in most cases that a new disc will be needed.



This very professional-looking outfit is the back of a Marconi television transmitter's scanning device. In practice it is mounted on a stand which carries heat-dissipating resistances, controlled from a switch on the front of the instrument.

The replacement disc will require a larger number of holes, the exact number being fixed by the scanning frequency of the new transmission. In most instances a new synchroniser will also be required.

It has been suggested that it will be possible to use our existing discs by running them faster, but I am not very optimistic about this idea. The necessary increase in speed is likely to be considerable, and the present driving motor could hardly be expected to do it, even with the aid of gears.

Synchronising Difficulties.

Moreover, there would be acute synchronising difficulties, and in any case this method would not take full advantage of the improved detail of the new picture. Opportunities for actual test have been lacking so far, but I doubt whether the scheme is practical.

The mirror-drum receiver will be a bit of a problem, too, and the simplest way out will be the obvious one of a new drum and synchroniser. This is a pretty expensive business, so it is not surprising to learn that experiments are being made on a method of optically multiplying the scanning lines of existing drums.

The method of which I have heard promising reports just lately uses a supplementary oscillating mirror driven by a cam gear, and it seems to offer considerable hope of quite a cheap conversion scheme. Of course, it can only be applied easily if the new transmission differs merely in the number of scanning lines: if the picture frequency is likewise increased it would require to be supplemented by running the drum faster, which may or may not be possible in any given case.

A Flexible Method.

A really well-made drum should permit of running at double speed, although this may call for a more powerful motor in some instances. Drums which do not run absolutely smoothly and without the least sign of tremor or vibration at their present speed, of course, will most certainly *not* tolerate any such increase.

When we come to the cathode-ray system of reception we find the problem becomes simple in the extreme, and we begin to realise what a truly flexible method this really is. All we have to do here is to make quite a trifling alteration in our time-base circuits, and then a few minutes of adjustment will bring the apparatus in step with

(*Continued on page* 126.)

FEWER B.B.C. CONCERTS?

News about broadcasting and broadcasters.

The Café Colette Orchestra, with Walford Hyden, its leader.

AFTER negotiations of many months a kind of working arrangement has been arrived at between the B.B.C. and the Royal Philharmonic Society. Under this there will be a reduction of the number of B.B.C. public concerts next season, and Sir Thomas Beecham will conduct on at least two occasions for the B.B.C., Dr. Boult returning the compliment for the Philharmonic.

* * *

That Staff Memorial.

That Sir John Reith was able to produce a special memorial of personal loyalty from his staff when he visited the House of Commons recently was due to the initiative of Miss Taylor, of the Finance Department. Miss Taylor is one of the pioneers of the B.B.C., having been secretary and principal assistant to Rex Palmer when he was London Station Director, and afterwards in charge of artistes' booking.

* * *

They Didn't Sign.

I hear that there were rather more than eight hundred names on the memorial. This means that there were about a hundred abstentions, most of them, no doubt, due to the rushed character of the procedure.

Anyway, the circumstances of the abstentions will not escape comment.

* * *

Meeting Press Attacks.

The B.B.C. has not been nearly so calm as usual in the face of recent Press criticism. In the past such criticism was studiously ignored—often an effective "retort" in itself.

It looks as though, as the time draws near for the revision of the B.B.C. Charter, that institution will come under increasingly searching scrutiny. If there is any loss of nerve at Broadcasting House, affairs will go badly for the B.B.C.

* * *

The Organ in Trouble.

The much-discussed organ installed in the Concert Hall of Broadcasting House, at a cost of between seven and eight thousand pounds, is likely to become a "white elephant."

The trouble is not with the organ, which apparently is a highly efficient instrument. The trouble is that when the organ is played the noise penetrates through several floors of the studio tower, putting out of action at least six studios.

A pretty problem!

* * *

Continental Programmes.

I hear that the B.B.C is making another effort to get the sponsored programmes in English from the Continent suppressed. Pressure is being brought to bear both on continental governments and broadcasters.

Meanwhile, those interested in the sponsored programmes are organising in self-defence, and have a Parliamentary Committee.

* * *

Back to "Sweet" Music.

Henry Hall's recent statement that comedy dance numbers no longer attract popularity, and that we are back again in the "sweet" melody era, will please those few dance band directors who have never succumbed to the temptations of "hot" music.

Charlie Kunz and the Casani Club Orchestra make a case in point. We shall probably be hearing more of them during the summer.

* * *

Prince George's Homecoming.

When Prince George returns from his South African tour he is to be entertained at a banquet at Grosvenor House on Wednesday, May 2nd, and arrangements have been made to include his speech in the National programme.

The banquet is being given by the Royal Empire Society, the British Empire League, the African Society, the Victoria League, the Overseas League and the British Empire Club.

* * *

Sir Austen Chamberlain on "England."

Sir Austen Chamberlain will propose the toast of "England" at the annual banquet of the Royal Society of St. George, which is to be relayed from the Connaught Rooms to National listeners on April 23rd.

Another topical programme will be the performance, on April 24th, of Clemence Dane's great classic, "Will Shakespeare," in honour of the dramatist's birthday. Val Gielgud, B.B.C. Drama Director, will produce the play.

* * *

The "Broadcast Beauties."

The Eight Step Sisters are shortly leaving the B.B.C. to tour a number of theatres and music-halls.

In their place the B.B.C. is searching the country for representative British girls who can sing, dance and look beautiful.

It will be strange if this decision has not something to do with the present developments in television.

* * *

Birmingham "Rep's" Twenty-Firster.

The Birmingham "Rep" will soon be celebrating its coming of age, and the B.B.C. is marking the event by broadcasting a performance of "Sad About Europe," which takes place on Wednesday, April 11th.

The production will be preceded by a talk by Sir Barry Jackson, in which he will give some reminiscences of the early days of the Birmingham "Rep" and of the famous experiments by which the theatre broke new ground.

* * *

Regional Director as Interviewer.

Mr. Percy Edgar himself will be appearing before his own Regional microphone on the following evening, when he will interview Tom Costello for reminiscences of the early days of variety.

Birmingham produced many famous entertainers. Vesta Tilley, George Lashwood, Pat Rafferty, the Flying Dillons, the Flying Hanlons and the Brothers Griffiths are a few that can be added to the list with Tom Costello, who incidentally was seventy years of age when he made his first microphone appearance.

* * *

Concerts from Torquay.

Two concerts by the Torquay Municipal Orchestra and another concert relayed from the Princes Theatre, Yeovil, are in the West Regional programmes on Tuesday, Thursday and Friday, April 17th, 19th and 20th respectively.

* * *

Schoolgirl Prize-Winner.

The solo artiste in the first, which will take place at the Pavilion, Torquay, will be Mabel Ritchie, a soprano singer who started winning prizes when she was a schoolgirl, and now plays leading rôles in both grand and comedy opera with the Covent Garden Company. London listeners know her for several fine broadcasts.

Audrey Piggott, who will play 'cello solos in the second Torquay concert (to be relayed from the Spanish Barn, Torre Abbey), also began her musical career when very young.

O. H. M.

"WHITHER HOGSNORTON?"

Mr. Gillie Potter, advertised to speak on the above subject, did not once in the course of his lecture mention the word "Hogsnorton"!

VOICED FROM LONDON.

Heard on the London National:

"The number you have just heard was on His Majesty's Voice Record No. - - - - -."

DIDN'T KNOW WHERE HE WAS.

A dance music announcement from the London Regional:

"This is Roy Fox and his Band broadcasting from the Kit Cat Res - - - - Er, sorry! From the Café de Paris, London."

"HOTTING-UP" is a term with which all motorists and most radio enthusiasts are very familair. Its appeal to both classes probably has something to do with the idea of getting something for nothing. So long as we don't expect to get *too much* for nothing, all is well!

This same hotting-up business, however, is two-sided. Very often it consists merely of doing something, as an afterthought, which ought to have been done in the first place. It is particularly this side of the business that I want to deal with.

Every single reader of these notes must have wondered, at some time or other, why two apparently identical receivers gave such different performances. If you were lucky you asked why yours was so much better than somebody else's. If, on the other hand, you were unlucky—but why bring that up?

Two Critical Sections.

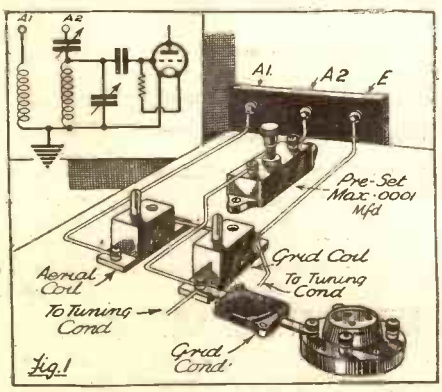
It is my opinion that there are two main departments of short-wave radio in which many fail. The first is the detector, and particularly the aerial circuit, and the second is the L.F. amplifier.

There is not much point in arranging a very efficient detector circuit if you don't possess an equally efficient arrangement for transferring your signals into it from the aerial. Our American friends often refer to this part of the set as the "injector"—a very expressive term.

HINTS ON "HOTTING-UP"

Never decide that you have reached finality with your short-wave receiver. However good the results it may give they can always be improved by "hotting-up," some suggestions for which are contained in this authoritative contribution.

ALTERNATIVE COUPLING



With a circuit arrangement such as that shown here, almost any degree of aerial coupling can be obtained.

Fig. 1 illustrates an easy way of arranging a flexible aerial coupling device that can readily be adjusted to suit all needs; Terminal A1 gives tight, untuned, inductive coupling; while terminal A2 gives capacity coupling with a variable degree of "tightness," according to the setting of the coupling condenser.

Although I am rather chary of saying so, it is my opinion that the aerial coupling on short waves should always be as tight as possible, provided that it does not introduce undesirable effects. The chief fault among practically all short-wave enthusiasts is that they don't know an undesirable effect when they hear one.

Coupling that is *too* tight may cause dead spots in the tuning, inselectivity, instability or, of course, in an extreme degree, it may stop the set oscillating altogether.

So many people tighten up their coupling until the last condition is reached, and then try to remedy matters by using a larger reaction coil. This is all wrong.

Decide, first of all, on the size and position of your reaction coil, and then make your coupling as tight as you can without introducing flatness into the tuning.

Test Your Aerial "Injection."

Now for those who err in the other direction. I have met people who use an untuned aerial coil, of a quite unsuitable number of turns, coupled far too loosely. In more than one case I have completely upset the apple cart by showing them that signals are every bit as strong with no aerial on the set at all!

Just try this test—remove your aerial and earth it, and find what you can hear. It will probably have the effect of making you think deeply about your coupling device. Every "hotted-up" set should certainly be equipped with the two alternative schemes shown in Fig. 1. The rest is a matter of individual experiment.

Now for No. 2! So many folk don't seem to have the foggiest notion of what one good L.F. stage ought to do. They use a cheap and nasty transformer, a doubtful valve, any old value of grid bias and hope for the best. If it doesn't come up to expectations they slam another stage on the end—probably worse than the first—and grumble about threshold howls and instability.

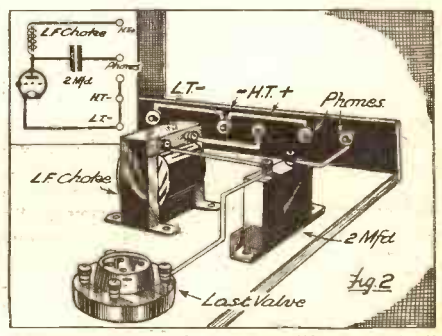
There should *never* be the slightest need to use more than one note mag. for headphone work. Don't spoil the efficiency of the transformer by putting resistances and volume controls across its secondary. If the latter is necessary it shouldn't be of a lower value than 1 or 2 meghoms.

Use choke-filter output, as in Fig. 2. This is a great help in keeping things stable, and is one of the best cures for that annoying disease known as "head capacity"—"hand capacity" run riot and chased up the 'phone leads.

Use Good Quality Parts.

The low-frequency side of a short-wave receiver should receive at least as much attention and consideration as the similar part of a set designed for medium and long-wave reception. Many people seem to be of the impression that the quality obtainable from short-wave stations is pretty poor anyway, and therefore it is of no avail to use good L.F. transformers. Such an idea is quite fallacious.

CURING "HEAD CAPACITY"



A filter circuit not only overcomes "head-capacity," but improves the general stability of the receiver.

Use a good transformer, a good valve, don't economise on H.T. and be careful with your grid-bias value. If only you will take a little trouble over all this I can promise you that it will be amply rewarded.

In a later article I want to deal with some of the finer points of "hotting-up," but so many people obviously haven't yet grasped even the elementaries that I feel quite justified in rubbing them in first.

On the Short Waves—*(Contd. from previous page.)*

WHAT READERS ARE SAYING

RECENT remarks about the Soviet commercial stations using high power on the amateur wavebands have brought forth a letter from Mr. Don B. Knock, Technical Editor of "Australian Radio News," on the same subject. He says that even in Australia they are a very serious nuisance. Why *do* they do it?

"S. I. K." (Barnstaple) has logged an interesting series of intelligibility tests on the transatlantic 'phone in the region of 30 metres. They consist of word-lists and series of proverbs with one wrong word in each. He also had the thrill of his life by hearing W 1 X A Z relaying the ceremony of the coronation of the young Emperor of Manchukuo via Tokio.

Two Sets on One Aerial.

"R. S. W." (Towcester) has heard an Australian, probably V K 2 H R, on 28 metres, and X G R, Shanghai, on 26 metres.

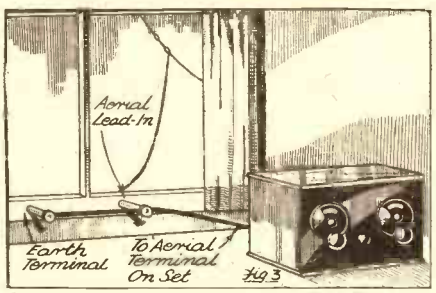
"R. H." (Purley) asks for identification of two stations. The first appears to be Jeloy, Norway (42·92 metres) and the second Zeesen, Germany, on 25·21 metres.

"A. W. A." (Hull) quotes a very interesting method of running a short-wave set and the family broadcast set *simultaneously* from the same aerial. He simply connects his B.C. set to the end and the short-waver to the centre! There is not a trace of interference between the two sets.

"I. S." (Glasgow) has succumbed completely to the short-wave "bug," and sends a long and newsy letter. He is very enthusiastic about the use of an S.G. stage, as in the "H.A.C. Three-Valver." His bag of short-wave broadcast stations shows five African, sixteen North American, five South American and one Australasian station, so he appears to thrive on it!

By the way, "I. S." suggests that readers ought to look for Barranquilla, Colombia (H J 1 A B B), on 46·5 metres round about midnight.

REDUCING STATIC



This suggestion will be of special interest to readers who have to use a long earth lead.

By way of contrast with the foregoing, "F. H. B." (Worcester) also has an "H.A.C. Three-Valver," but "detests two tuning dials," and has cut the S.G. stage out!

"H. J. B." (Manchester) comments on the good conditions prevailing up there of late. I am not sure whether we poor Cockneys find them so good down south, but we certainly have had a rest from those long "dead" periods lately.

"J. W. H." (Stoke-on-Trent) has a few choice remarks to make about short-wave condensers that develop wear in the bearings and make nasty noises. He says that the slightest trace of "rock" in the panel fixing bush will start them off. I have always found a smear of graphite grease the best cure for this trouble.

He wants to know of a firm specialising in the remagnetising and rewinding of headphones. I suggest he gets into touch with E. Mason, 44, East Road, London, N.1.

"T. D. M." (Brierfield) wants indentification of a station on about 49·4 metres, the announcements from which "sound like Spanish or Italian." I should suggest Skamlebaek, Denmark, as a possibility. From other remarks that he makes, however, it seems like Maracaibo (Venezuela). Has anyone found him on that wave?

Using H.F. Pentodes.

"J. W." (Wimbledon) strongly recommends screened H.F. pentodes as substitutes for the normal S.G. stage on a short-waver. He promises a remarkable gain in selectivity as well as sensitivity, probably owing to the lower inter-electrode capacity. He also mentions a very bright scheme for improving band-spreading which I hope to deal with later.

The sketch on this page shows a brain-wave for those who are troubled by severe local interference. The aerial is simply connected direct to earth and the set hitched on the common point! It gives a sort of H.F. potentiometer effect, depending on how near the top of the house you reside. I find it extremely useful, and managed to listen right through a severe thunderstorm the other day. **W. L. S.**

ROUND the RECORDS

Selections and recommendations from the latest gramophone lists

I ASKED last time in these notes what was the most beautiful melody, and suggested that the *Londonderry Air* would take a lot of beating for first position in the hearts of the music-loving public. Right or wrong, it seems that it is not the most recorded piece of music, according to the information supplied by one of the leading gramophone concerns.

That title goes to Handel's *Largo*, which has been rendered scores of times by all sorts of artistes, and which is not yet by any means exhausted as a "number."

Another "Largo" has just been "waxed" by the famous cellist Pablo Casals, who is unfortunately not often heard on gramophone records. This piece is by Vivaldi, and is accompanied on the other side by two tuneful dance movements of great fascination. They are Valentine's "Gavotte" and de Lasema's "Tonadilla." (H.M.V. DA1118.)

FINE ORCHESTRAL RECORDINGS

Two orchestral items on H.M.V. records deserve special mention this week. One is the ever-popular "Berceuse" by Jarnefelt, accompanied by the same composer's "Praeludium," and the other disc contains "Chopiniana" by Glazounov.

The former record is made by an orchestra conducted by John Barbirolli, and is of light character, while the other recording is made by the London Philharmonic Orchestra under the baton of Sir Landon Ronald. This recording takes up three sides of twelve inches each, the fourth side (completing two records) containing the delightfully rendered "Bees' Wedding" and "Spring Song" of Mendelssohn.

Peter Dawson is still going strong, to the delight of thousands of gramophone users. His latest achievement in the world of wax is the recording of the world-famous "Joggin' along the Highway" and another favourite, "Here is my Song." Breezy recordings that will appeal to nearly everybody. (H.M.V. B8120.)

One of my favourite tenors is Heddle Nash, whose pure, even production is always a wonder and delight to me. His must be one of the finest of voices for recording, and he is at his best in "To Mary" and "Mary." These gems are to be found on Columbia DB1319, and all lovers of pure tenor ballad singing should hear them.

With Arthur Sandford at the piano, Debroy Somers has launched further into the "canned" classics type of recording by playing the first of what promises to be a new series called "Classics in Cameo." He has chosen Tschaikowsky's *Concerto in B Flat Minor*. It does not appeal to me, though I am ready to admit that Somers has crowded a wonderful amount of the atmosphere of the original work into the two sides of the twelve-inch Columbia on which it is recorded.

To the classically minded music lover I should think that the record will sound somewhat of sacrilege, while to the light or "popular" fan it will be more or less unintelligible. It is a record that must be heard to be believed.

Down the scale (according to the "best" musicians) or up towards the light (in the view of popular music lovers) we find that Debroy Somers has made a most attractive disc containing "The Little Dutch Clock" and "Sun in my Eyes." They are quite different from one another, and both enjoyable. (Columbia CB711.) The kiddies will enjoy the former, too.

If you have a hobby you should listen to that prize pair, Clapham and Dwyer, discoursing on everything in general and nothing in particular, as recorded on Columbia DB1323. They call the record "Hobbies," but you will hear how much they get said about any hobby when you try it over.

ITEMS FOR DANCE ENTHUSIASTS

I have had a large number of dance and similar items in the last batch or so of records, and it is difficult to pick out any particular items without being unfair to others. One record that attracts me very much is by Decca of the dainty Fred Hartley Quintet playing "Midnight, the Stars and You" and "No More Heartaches, No More Tears." It is on F3916, and I am sure you will like it.

The Street Singer's efforts on Decca F3913 do not appeal to *me*, but as he is very popular with a lot of people I feel I must draw your attention to the record so that you can make your own choice. He is singing "Take me in Your Arms" and "Sleep, My Darling, Sleep."

Ray Warren, in "Croon To Me," on another Decca is also worthy of notice, though here again the division of like and dislike will be fairly well defined Anti-crooners will not be attracted, of course.

Among the very latest records I have received are several light music gems that will appeal no less for the personalities that are depicted thereon than for the voices and numbers they sing. I refer to Noel Coward and Yvonne Printemps in two recordings from the new *Conversation Piece* album I mentioned last time; to Evelyn Laye singing two of Ray Noble's numbers from the film *Princess Charming*; and to Gertrude Lawrence, who sings two items from *Big Business*.

The Noel Coward record is well worth hearing, though it is mainly taken up by Yvonne Printemps. She does all the singing, the small amount of talking sufficient for the listener to grasp what it is all about being done by Noel Coward. On the disc is "I'll Follow My Secret Heart" (marked as Act 1 Pt. 1 and Act 1 Pt. 2) and taking up both sides You'll like it.

TWO CHARMING EVELYN LAYE NUMBERS

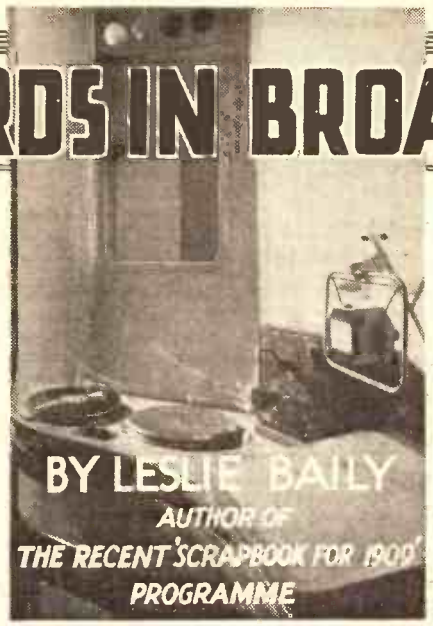
Evelyn Laye is altogether charming in "The Princess's Awakening" and "Love is a Song." Both are tuneful numbers, of which I prefer the latter, and, of course, theatre-goers will need no introduction to the charms of her personality and voice.

Gertrude Lawrence sings "What Now" and "An Hour Ago This Minute," two very attractive numbers from the recent radio musical comedy *Big Business*, of which the last is deserving of special notice on account of its melody. All these records are made by H.M.V.

"Coffee in the Morning and Kisses in the Night" is the alluring title of one of the numbers in the latest Brunswick record releases. It is sung in usual harmony style by the Boswell Sisters with the Dorsey Brothers Orchestra, and is coupled with "Song of Surrender" (01711). There is a little too much solo singing for my liking and not enough of the characteristic harmonising of the famous sisters; but it is a good record, and one that you should hear.

So also is the latest disc by Aileen Stanley, popular American star, who makes a very attractive record of her hits on 01722 (Brunswick). It is called "Aileen Stanley Song Successes," and on it she records such famous numbers as *Gonna Get a Girl, Side by Side*, and *Here Am I, Broken-hearted*, all of which she weaves together into a semblance of a story. **K.D.R.**

MORE RECORDS IN BROADCASTING?



who gives us a vision of a B.B.C. almost entirely mechanised for entertainment. What do you think about it ?

IN the recent "Scrapbook for 1909," Charles Brewer and I drew on the combined resources of studio and gramophone record more extensively than is usual. In this hour of music and drama we used a cast of sixteen, the B.B.C. Theatre Orchestra, an organ, "effects" and about a score of gramophone records. Some of these last we dipped into for only a few seconds—as in the case of the reproduction of words spoken by the late Sir Ernest Shackleton on a record made in 1909.

It was to us an interesting experiment in what can be done in this way. Recorded sound is destined, I believe, to play an increasingly important part in broadcasting.

There will always be some programmes that must be "actual" as distinct from recorded. But records have certain legitimate uses, and the prejudice against them in some quarters is disappearing—at least in Europe.

Extraordinary Prejudice.

In America this prejudice is quite extraordinary. American listeners would not approve of our action in "Scrapbook" of playing a record, specially made in Paris, of M. Blériot's description of how he crossed the Channel in an aeroplane twenty-five years ago; they would want Blériot at the microphone in the flesh or not at all.

Unable to get him personally, Brewer and I preferred the record as a valuable and (I think) satisfying substitute.

The B.B.C.'s rule in these cases is to tell listeners frankly that a record is used. Only in exceptional circumstances is there any concealment. On the afternoon of Christmas Day the "round-the-world" programme included an apparent relay from New Zealand; but it happened, for technical reasons, that the afternoon hour was not a favourable time for reception from the Antipodes, and rather than risk a fiasco the B.B.C. "took" the speech from Wellington several days before Christmas and recorded it.

I contend that in the above instance the B.B.C. was perfectly justified in its little deceit. No good purpose could have been served by telling listeners that it was a record, and it would have prejudiced the artistic cohesion of the programme.

Wholesale deceit would, of course, be quite easy on the radio in these days when gramophone recording is so good as to be almost indistinguishable from a studio broadcast; and, in fact, some of the Continental stations are guilty of flagrant false pretences.

Is the Real Thing Essential?

But, to do the B.B.C. justice, it has very rarely bamboozled the public. It is not true that the song of the nightingale is relayed from a record! And every time you hear Big Ben's chimes on the wireless they really are coming from the great clock at Westminster.

It would be quite easy to put over these (and, indeed, almost any) programmes from specially made records. But there is an over-ruling psychological objection. The listener likes to feel satisfied that he gets his time direct from Big Ben; that he listens to a bird which really is at that moment singing to the summer night in a Berkshire wood; that the variety show which he is enjoying is actually going on in a B.B.C. studio.

Slightly more polished artistic results might perhaps be achieved if we were to record the variety show and then, at the hour of the broadcast, simply play the records to the public. But the public wouldn't stand for it. They want the "real thing." This applies, at any rate, to programmes such as variety, talks and outside relays in which the sense of "actuality" is important. It applies less to music; and less still to radio drama, which depends on the opposite to actuality—on establishing an illusion.

When you go to the cinema you don't expect to see and hear "actuality." You are offered recorded sound and sight—recorded on a strip of celluloid. Why, then, should anyone object to radio plays from records? They would be superior to the plays as transmitted now direct.

Isn't the present system of broadcasting plays fantastic? After a series of nerve-racking rehearsals the cast and producer assemble on the evening of transmission. They go into their studios in a thoroughly nervous condition. Each knows that by making a mistake he can kill the show. This applies especially to the producer, who sits at the dramatic-control panel drawing sound and speech from the numerous studios. This is about the most exhausting job I know.

It is Gone for Ever.

And when the show is over it is gone for ever! If it is to be heard on the alternative wavelength on another night, everybody must go through the same ordeal again. How much better it would be to produce the show in those same studios several days beforehand and, after getting it right in every detail, put it on records; then use these for as many transmissions as desired.

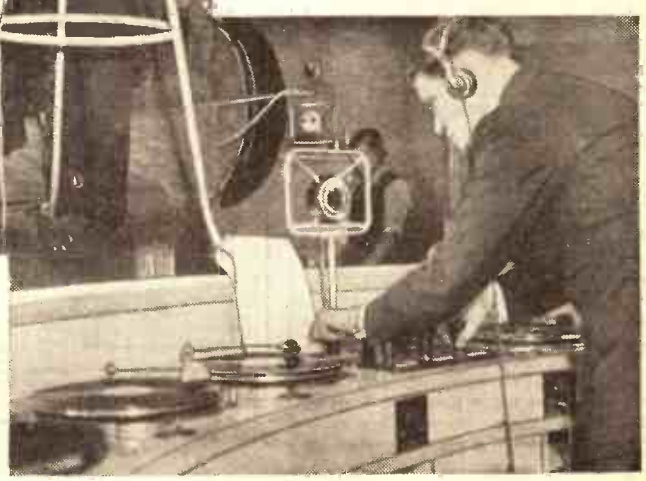
This, I feel sure, will come.

It would mean the installation by the B.B.C. of either sound-on-film or wax-disc recording apparatus, but that, in any case, is under consideration.

It may be that this recording controversy will be shelved by the arrival of television. When it comes as a regular entertainment it may be mainly in the form of transmissions of cinema film. You will sit at home, watching and listening to Mickey Mouse or Greta Garbo—in other words, to *recorded* entertainment!

WILL THIS EVENTUALLY—

—BECOME THIS?



The human element—or mechanised programmes? A scene from a radio play (the methods of which Mr. Baily condemns) and one of the banks of turntables in Broadcasting House for record broadcasting.

USING A PICK-UP

and other radio matters of practical interest to all enthusiasts are dealt with fully and lucidly in our special weekly article for beginners

By G. V. DOWDING, Associate I.E.E.

PARALLEL FEED TRANSFORMERS AND UNITS.

PARTICULARLY with the nickel-iron core L.F. transformer it is often desirable to arrange that the H.T. current does not flow through the primary winding.

By this means the saturation of the core is prevented and a greatly improved response frequently assured.

A parallel-feed circuit is shown at Fig. 1. The H.T. current reaches the anode of the first valve through the resistance, and the L.F. impulses are communicated to the primary of the transformer through the fixed condenser.

If it is desired to avoid the voltage drop in the resistance an L.F. choke can be used in its place.

The ratio of the transformer is unaffected by this method

"SHUNT" FEEDING

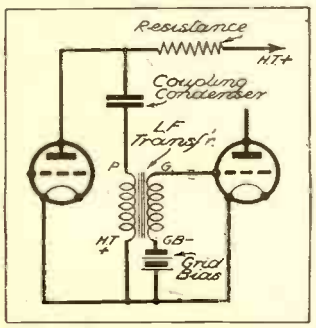


Fig. 1.—A parallel-feed circuit. The H.T. reaches the anode of the first valve through a resistance.

of connection, but there are other circuits which enable the ratio to be varied.

For example, Fig. 2 shows a scheme for obtaining a higher ratio. The primary and secondary windings of the transformer are joined in series and assist each other.

The ratio of a 1 to 4 step-up transformer becomes 1 to 5 owing to the inclusion of the primary winding in the secondary circuit.

The transformer has become an auto-transformer.

If the connections to the primary winding are reversed it will act in opposition to the secondary winding, and the effective ratio becomes 1 to 3.

Therefore it will be seen that when the primary winding assists the secondary (as in the diagram) the ratio is increased by the addition of 1 (a 1 to 4 becomes a 1 to 5, a 1 to 3 a 1 to 4 and so on), but when the primary is reversed the ratio decreases by 1.

PICK-UP.

A gramophone pick-up is in many respects similar to a microphone. But instead of it being actuated by sound waves, its motive force is derived from the wavy grooves of records which vibrate the needle backwards and forwards.

There are two types of pick-up in common use—the "needle armature," in which the needle itself generates the current by its movement between the pole pieces of the magnet in the pick-up, and the ordinary moving-iron variety.

Pick-ups vary considerably in sensitivity, but there are very few these days which cannot provide satisfactory results when two amplifying valves of normal magnification are used.

Volume Control is Essential.

But, in any case, records vary a great deal, so that it is practically essential to employ a volume control to adjust the input from the pick-up to the desired degrees.

Some pick-ups have what is known as a "rising bass characteristic." In plain language that means that the device gives emphasis to the bass notes. The object of this is to compensate for the falling-off of bass that occurs in records.

SERIES WINDINGS

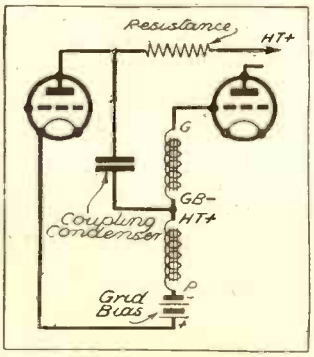


Fig. 2.—Here the primary and secondary windings of the transformer are joined in series, so that the transformer has become an auto-transformer.

But here, again, records vary considerably as with the different makes, and there is proportionally more bass in some than in others. Therefore, whether or not the pick-up is in any way "corrected" in its response, a tone control is an advisable fitment, and such is usually to be found as standard equipment on the modern set.

From Radio to Gramophone.

A simple form of radiogram switching is shown in Fig. 4. By the operation of a single-pole double-throw switch either radio or record working is available at will.

The diagram shows the detector valve only, though, if there are two stages of L.F. amplification and the pick-up is a rather sensitive one, then it may be as well to feed in at the first L.F. valve, for it will be

TRACKING—GOOD & BAD

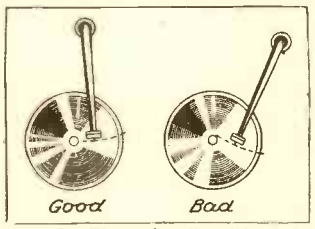


Fig. 3.—Illustrating the right and the wrong ways of fixing a tone-arm in relation to the record.

appreciated that a detector valve becomes an L.F. amplifying valve pure and simple when a pick-up is connected to it.

Note should be made of the position of the grid leak. Owing to its high resistance it does not affect the operation of the pick-up; but if it were joined to the "radio" side of the switch there would probably be a noisy change-over owing to the "opening" of the grid circuit.

It is important that the grid should be joined to the slider of the potentiometer volume control. If it were connected to one of the other terminals and a pick-up connection taken to the slider, tone would be altered as with volume adjustments owing to the consequent change of resistance across the pick-up.

The Adaptor Method.

The switch needs to be of very low self-capacity, otherwise radio will break through when the pick-up is working.

The grid bias will depend upon the valve. Sometimes one-and-a-half volts is sufficient, and seldom is more than three required.

To alter an existing set for radiogram switching often necessitates rather troublesome reconstruction. An alternative is to use an adaptor. The scheme is illustrated in another diagram (Fig. 5).

The detector valve is removed from its holder, placed in the adaptor, and this latter inserted in the vacated valve holder.

It is convenient to have the volume control on the motor-board of the gramophone. Any type of gramophone can be employed, but care should be taken to ensure that the motor runs at a uniform and correct speed.

"RADIOGRAM" SWITCHING

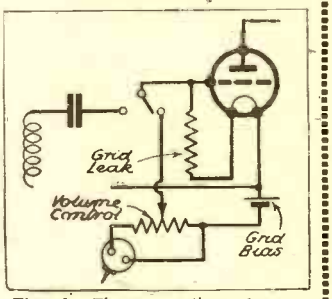


Fig. 4.—The connections for a switch to give radio or gramophone working as desired.

Good tracking is another desirable feature. That is to say, the needle must keep in line with the record grooves as closely as possible through the whole playing.

Usually the pick-up is offset (placed at an angle) to the tone-arm in order to maintain satisfactory tracking. In any case, the position in which it is fixed on the motor-board has to be chosen with care.

Generally the user need not worry about needle pressure, for the weight of the pick-up is a design factor, and some are even provided with carefully adjusted compensating balance weights in the tone-arm.

PRACTICAL WIRING

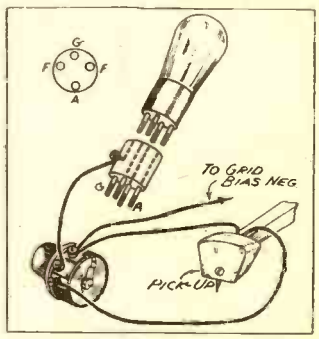


Fig. 5.—How to wire an adaptor for plugging-in a pick-up and volume control to a radio receiver.

A stop to make certain that the pick-up cannot swing right over to the other side of the record is most essential.

It should be remembered that the leads to a pick-up are in effect grid leads. Therefore, they are fruitful sources of possible instability.

Pick-up leads should, then, be kept as short as the circumstances permit. But with quite short leads instability often results. A cure is to use metal-shielded leads, the metal shielding being connected to earth.

HELPING the ELECTRON

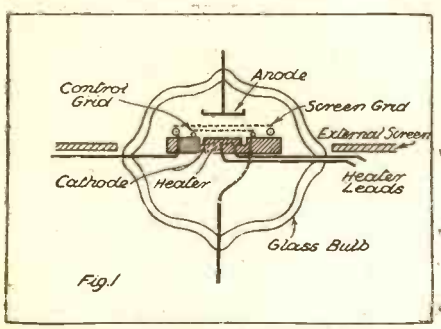
It doesn't take an electron long to travel from filament to anode, but it's long enough to count on the ultra-short waves! So special tiny valves have been designed, the operation and construction of which are here described

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.

WE may soon grow accustomed to valves that almost require sugar tongs to pick them up. In the last dozen years we have gradually become familiar with shorter and shorter wavelengths.

With a little care ordinary standard valves can be made to function on 5 metres. Usually the tuning coil consists of only about one turn, and the condenser is as small as possible. But readers who keep their eyes open will have seen accounts of wonderful experiments, by Marconi himself and others, with wavelengths much shorter still—for example, 50 centimetres (half a metre). What about valves? Ordinary valves are quite impossible for several reasons.

Everybody knows that to tune to any wavelength one must provide inductance and capacity, and it isn't necessary always to have them in the same proportion so long as the two multiply together to give the right amount for that particular wavelength. The parts of the valve itself have a small capacity—usually something like a fiftieth of the maximum capacity of an ordinary variable condenser.



The arrangement of the electrodes in the new valve is shown in this sketch. Note the position of the external screen.

Also the connecting wires inside the valve have a tiny inductance. Small though they are, even if nothing whatever is added outside the valve, they tune to one metre or thereabouts. So, obviously, there is no hope of getting lower in wavelength unless something is done to reduce the capacity and inductance of the valve.

The Delay in Transit.

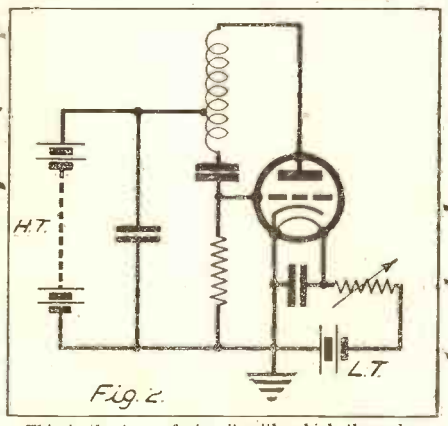
There is another snag. The current inside the valve, between filament and anode, is carried by the tiny electrons that are shot off from the hot filament and attracted to the anode by the H.T. battery. They move at an amazing speed—something like 1,000 miles a second—and have only a small fraction of an inch to travel.

You might think that the time taken for the journey could safely be left out of account. "This is an electron starting, that was!" But you have to remember that when the wavelength is one metre it means that 300,000,000 complete waves have to be formed every second. So the time taken for the current to traverse the valve has to be small, compared not only with our leisurely ideas of travelling, but with one three hundred millionth of a second.

As it happens, this delay in transit, although it throws the orthodox system of working out of commission, does actually form the basis of quite a different type of valve. What I have just explained will prepare you for the rather novel idea of controlling wavelength by H.T. voltage—for the higher the voltage the faster the electrons are pulled across.

Valves Are Just As Efficient

Most of the experiments you have read about have been carried out with valves of this sort. Not only is their exact method of functioning still hotly debated by high-brow scientists—that in itself would not be enough to prevent practical people from getting on and using them—but they are very inefficient and rather awkward to use. It is at the receiving end that they are particularly weak. So the valve people have been busy trying other ways of tackling the problem.



This is the type of circuit with which the valve being held in the right hand of the man in the photograph is used. In his left hand is the actual receiver employed.

If an ordinary valve is built on a reduced scale, all the limits to its application to ultra-short waves are reduced in the same proportion. The electrodes have a smaller area and therefore less capacity. The leads are shorter and so less inductive. The electrons have a shorter distance to cross to get to the anode.

But, you may say, surely the valve is less efficient—there is less filament, and the efficiency of modern valves is due to the large expanse of filament or cathode that is available. True—but this is offset by the reduced clearances between the electrodes.

Actually our reduced valve has just the same "slope"—or "goodness"—and the same amplification factor as the full-size edition. The only thing that does suffer is the amount of power that can be handled.

An Ingenious S.G. Type.

If you have rather good sight you may be able to see one of these tiny valves between the finger and thumb of the gentleman in the photo; the right hand, not the left—*that* is the whole receiver!

Two types of valve have been made experimentally: a triode and a S.G. model. Both are globular in shape and about three-quarters of an inch in diameter—roughly the size of a marble. The clearances between the electrodes are only a few thousandths of an inch, so the parts can't just be slung together.

The construction of the S.G. valve is rather clever. A small porcelain disc is used as a foundation, and the electrodes are held at the appropriate distances from it—and one another—by rings of different thicknesses; see Fig. 1. The anode doesn't matter so much, and is supported from the opposite glass wall.

In spite of their small size, both types have "slopes" well over one milliamp per volt; which is quite good for any American valve. The electrode capacities are a tenth of the usual amounts.

(*Continued on page* 124.)

"ECKERSLEY EXPLAINS"

IN QUEST OF QUALITY

By P. P. ECKERSLEY, M.I.E.E.

THE suggestion which arose out of my article on the "perfect set" seems, as I think about it, to be really constructive.

Single sideband transmission is, of course, well known. The transatlantic "long-wave" telephone uses single sideband transmission. But I do not think the suggestion to use single sideband transmission for broadcasting could have been seriously considered unless the receiver has a chance to evolve itself into a single sideband receiver. With the coming of the superheterodyne into Europe (it has long been established in America) we find ourselves with a means to achieve single sideband reception very simply.

* * *

I have been guilty of missing some points when I have discussed, in these pages, the relative merits of the straight set and the super. I have not seen these points brought out by the exponents of the super, so I will do it for them.

Station Selection.

In the past it seemed to me that there was little to choose between the super and the straight sets. In the former you have to have some filtration of signals, some tuning, that is, before the first detector. That tuning has to be fairly good to eliminate "second-channel interference." (The principle of the super involves the use of an oscillator which keeps a fixed frequency difference from the "wanted" signal.)

Suppose the wanted signal is of a frequency 700 kc. Then the oscillator is made to have a frequency of, say, 800 kc. The beat frequency is 800 — 700 = 100. But there may be another station sending on 900-kc./sec. frequency. This beats with the oscillator, too, to make 100 kc./sec., because 900 — 800 = 100, too. The second-channel interference is caused by the 900-kc. transmission (unless "tuners" are arranged to accept the 700 and tune out the 900).

But, you say, it doesn't require much tuning to select between two stations of 200-kc./sec. frequency difference. (The difference is always twice the beat or intermediate frequency; you will realise this by considering the example I gave you above.)

That looks true until you realise that selection in straight sets relies upon detector demodulation—that is, selection in straight sets only requires that the wanted signal should be about three or four times as strong as the unwanted, at the detector; the rest of the selection takes place due to demodulation effects.

The Question of Demodulation.

In a "super" there is no demodulation as regards second-channel interference, and although the frequency difference may be 200 kc., or of that order, the selection required has to favour the wanted signal not as 10 : 1, but more like 100 : 1.

So I was perfectly right when I said that high-frequency tuning or filtration of signal or selection presented nearly as difficult a problem in a super as in a straight.

What I missed when discussing these things before was that, in a super, you have the chance to make a really narrow window through which to see the wanted-station spectrum, and that, given a reasonable amount of money to spend on the design, this can be made so narrow and so steep-sided that we could use the super as a single sideband receiver.

"TRANSATLANTIC PHONE"

"The transatlantic 'long-wave' telephone uses single sideband transmission." Our photograph shows the station house at Rugby which deals with this class of work.

Mark you, I think that the superheterodyne of shoddy design is probably, unconsciously, turned into a single sideband receiver, more or less, by the user. He adjusts his dials to give him what he considers to be the nicest noise.

The properly designed super, plus single sideband transmission, could get over all this ambiguity.

To find recommendations for the super is perhaps more difficult than to find condemnation for the straight set. I have been doing analytical and practical work on "tuning." I find that a straight set with variable-mu volume control offends against every desirable quality in a decent design. But I will take back all that and say that, for a price and with given compromises, I couldn't advise anyone to use anything else!

Price for price, the straight set still wins. In performance the cheap super and the cheaper straight are probably on a par—with, perhaps, a slight gain if the designer of the super knows what he is doing.

My Job is to Explain

My job in these articles is to explain. There are so many "ifs" and "ands" and "buts." Let me summarise.

I was asked, "What would I do to design the perfect set?" I said, give me better transmission and I will give you a better set. What would improve transmission? Why, to stop the overlap of station sidebands, to send "single sideband transmission." How would that help the receiver? By allowing one to design single sideband receivers so that there wouldn't be any inter-station interference.

But I added, gratuitously, one has to consider the cheap every-day receiver. Which is better of that class: the super or the straight? My answer is that formerly I could find little difference; to-day I do see that, properly designed and even in the cheap class, the super might be better. Everything is wrong with the straight set, considered from an ideal standpoint, but it works by compromise. The day must come which sees its obsolescence. It will come by cheapening "super" technique.

THE LINK BETWEEN

Notes of interest to buyers by G. T. KELSEY.

I UNDERSTAND on the highest authority that there is to be a very considerable extension in the commercial set-making activities of Messrs. Radio Instruments in the near future. Plans are in an advanced state for the production of four entirely new models, the first of which is to be available at the end of April.

My informant tells me that the first is to be a de-luxe superhet receiver for A.C. mains which will be priced at approximately 18 guineas, and an outstanding feature of the design is that no controls will appear on the front of the cabinet.

R.I.'s have established a reputation for quality articles which is second to none, and for that reason I look forward with more than usual interest to the release of details concerning these new models. "P.W." readers may rest assured that further details will be published in these notes as soon as they are available.

New Ferranti Circuit Tester.

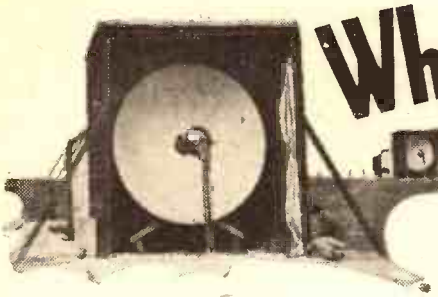
Ferranti's, famous of old for their electrical measuring instruments, have recently produced an A.C.-D.C. circuit tester which, from the descriptive matter, has every appearance of being a sort of radio "Aladdin's Lamp"! It measures A.C. and D.C. volts up to 600, A.C. milliamps from 0–1, D.C. milliamps up to 750 and resistance up to 50,000 ohms. As a matter of fact, with an external voltage supply of 600, it will measure resistance up to 30 megohms.

Very Moderate in Price.

The price of this new instrument is £5 15s., a figure which, in my opinion, is very moderate. It's a lot of money, I know, but you calculate what it would cost you to buy separate instruments to do all that this modern wonder does, you will readily appreciate why I regard the price as so very moderate.

Just as a matter of passing interest, readers may welcome the news that it is available on hire-purchase terms. It can be obtained for a deposit of £1, and 12 monthly payments of 9s. 7d.

(*Continued on page* 126.)



Why "OPTICAL" WAVES?

The contention is raised in this article that we are not justified in singling out the ultra-short waves as recipients for the terms "optical" and "quasi-optical." It is a contention ably backed by sound arguments and clearly propounded

By A. S. CLARK.

CAN wireless radiations be part light waves and part radio? It's a question which anyone not fully conversant with short-wave lore might ask, for the descriptions "optical" and "quasi-optical" are frequently applied to wavelengths of five metres and less.

The fact that both radio and light waves are vibrations of the ether (though widely different in frequency) has nothing to do with this close classification of the two types of vibrations. The reason, though many will not agree with me, is really due to coincidence.

Controlled by the Transmitter.

When ultra-short waves were first investigated, they were found to exhibit certain characteristics which were very similar to those of light. Hence the derivation of the term "optical waves."

Chief among these characteristics was the fact that the rays apparently travelled in straight lines and did not follow the earth's curvature like those of longer wavelength.

The distance that a person can see on a perfectly clear day depends upon his height above the surrounding country, assuming the latter to be quite level. Similarly, the range of ultra-short waves was assumed to be controlled entirely by the height of the transmitter.

Another feature which increased the parallel between light and ultra-short radio waves was the complete failure to detect any reflected ray from ionised layers above the atmosphere of the earth.

Suspecting the First Flaws.

The "clinching" factor in the simile was produced when it was found that a large parabolic metal reflector focused these short waves into an unidirectional beam just as the reflector of a car headlamp directs the light from the bulb.

The first flaws in the descriptive parallel were suspicioned when organised tests on five metres were started. Reports of reception outside the optical range became quite frequent—too frequent to be dismissed as freaks.

So the term "quasi-optical" was introduced to cover the case, the word "quasi" being used as meaning "more or less," rather than in its strict dictionary sense.

Enthusiastic Dutch amateurs, by extensive tests, eventually decided that five-metre waves were $1\frac{1}{3}$ times optical waves. That is to say, they travelled one-third as far again as light waves might be expected to reach.

History-making Tests.

But the well-defined and complete shadows produced by hills where "five metres" were concerned still seemed to uphold the "optical" analogy. This effect is very well illustrated by the diagram below.

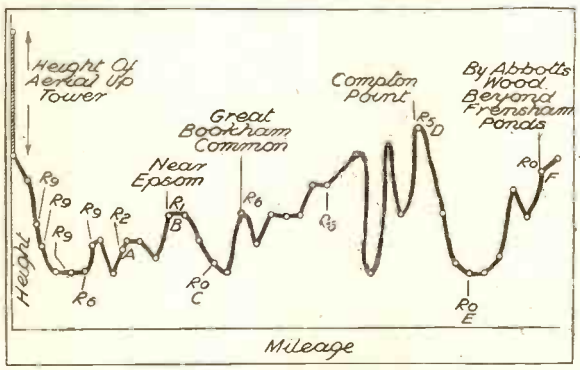
The sketch crystallises the data obtained with a portable receiver in a car during the POPULAR WIRELESS history-making five-metre tests from one of the Crystal Palace towers last year.

Starting from the bottom of the tower itself, I journeyed in roughly a south-westerly direction, taking measurements of strength wherever it was possible to stop the car dead on a compass course from the Crystal Palace. The figure shows the elevation of the land on the course, the ratio of height to distance being considerably exaggerated for the purpose.

Complete Lack of Reception.

The low strength at A and B can be attributed to local conditions, but the complete lack of reception at C and E is obviously due to shadow effects: similarly at F, although a line joining this point to the transmitting aerial is only just interrupted by the high peak D.

HOW HILLS AFFECT STRENGTH



In this diagram, the wavy line represents the elevation of the country in a direct line from the tower which carries the aerial of a five-metre transmitter. The numbers following the letters "R" represent signal strength at the various points.

These facts would certainly appear at first sight to bear out the supposition that ultra-short waves are propagated in straight lines and do not bend downwards to the earth. But as real proof they do not bear close investigation.

After all, the ordinary broadcast wavelengths suffer from shadow effects produced by mountain ranges. Surely it is merely a matter of degree, the shorter the wavelength the more noticeable being the effect?

And that brings me to my contention. All radio waves exhibit the same properties as those which have caused the higher frequencies to be termed optical.

The difference is merely a matter of degree. And since light waves, like radio waves, are electro-magnetic vibrations of the ether (only of much higher frequencies), it is natural that the shorter the radio waves the more they exhibit phenomena usually ascribed to light.

Why the Sun Looks Red.

Considering the other points that were mentioned at the beginning of this article, we have first the fact that so-called optical waves appear generally to stop short at the same point approximately as light.

This is easily explained. It is well known that the lower the wavelength the sooner the ground wave is absorbed. If you go low enough it is quite natural that the ground wave at some frequency will only travel as far as light. And, anyway, remember that light waves bend round the earth's surface to some extent; that, as a matter of fact, is why the sun looks red when it sets.

(As a point of interest it may be mentioned that Marchese Marconi recently showed that consistent reception of very short waves *is* possible beyond the optical range.)

The reflected ray of ultra-short waves probably originates at a layer so high above the earth's surface that the ray fails to touch the globe at all on its downward path.

And, finally, focusing. Well, even the comparatively long waves used for beam transmissions can be focused by "wire-mesh" reflectors. And so could any other radio wave if large enough reflectors were made.

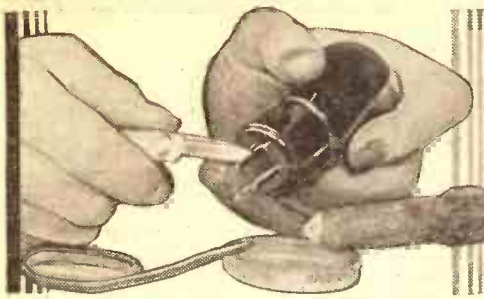
Producing Light.

It is entirely a matter of degree, and I submit to you that the term "optical waves" is very loose and not truly descriptive by any means.

Having shown, in the foregoing, that the only real difference between light and radio waves is in frequency, since they are both electro-magnetic vibrations in the ether, an interesting supposition arises.

It is this: Suppose, one day, we are able to produce sufficiently high frequencies by radio means for the wavelength to come within the light part of the spectrum, shall we have produced light?

If we have, some amazing effects are to be expected in the form of colour radiations from the aerial. Similarly, we may one day be able to detect light by means of a radio receiver.



NEW USES for OLD VALVES

Many valuable uses can be found for old out-of-date valves, including such modern schemes as automatic volume control and battery economisers. Below are given constructional details that will be of interest to all set-owners.

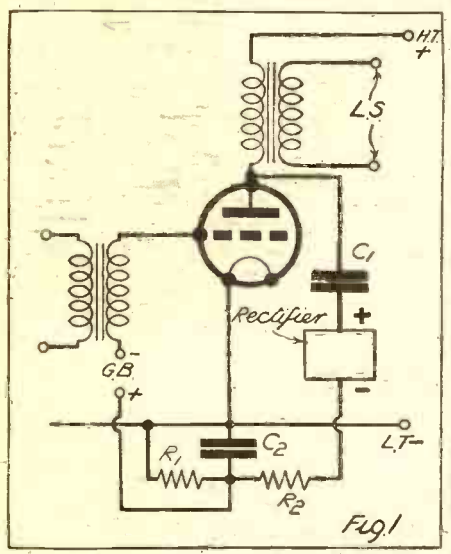
By "KRYPTON."

THE new systems of getting a large loud-speaker output for an H.T. current consumption within dry-battery limits, Q.P.P. and more especially Class B are now all the rage; but revolutionary and excellent as they are we cannot shut our eyes to one obvious drawback—the necessity for special components and valves.

If this matter of initial expense is the only obstacle to your enjoyment of the luxury of mains-set volume, which Class B undoubtedly gives, and if you can be content with just a little less volume, there is another way out—the battery-economiser system. This achieves the same result of maximum volume for minimum H.T. current consumption at much less expense.

No special transformers or valves are required: just a few minor alterations to your present receiver and a few extra components. In fact, the experimenter with a well-assorted junk box will find that this remarkably good alternative to the Class B system will cost him practically nothing at all.

KEEPING DOWN CURRENT



A typical economiser circuit for anode current control, using a dry rectifier.

How the Scheme Operates.

The bare bones of the battery-economiser circuit are, first, the over-biasing of the output valve so that during silent intervals its anode current is very small, and, second, a device which reduces the negative grid bias by an amount depending on volume. Thus the output valve consumes only just sufficient anode current to suit the volume to be handled, with the net result that the average H.T. current load is much reduced. You can then afford to use a bigger power valve without increasing your annual bill for H.T. batteries. The full advantage of the system is, of course, only realised by using a larger output valve than your present one.

If you are now restricted to a small-power valve you can with this system change over to, for example, a super-battery pentode without increasing H.T. running costs.

As you will see from Fig. 1, the only additions to be made to your receiver are a connection to the anode of the output valve and a change in the grid-bias circuit. A separate grid battery of double the voltage normally recommended for the output valve is required here.

Varying the Grid Bias.

Part of the L.F. output, insufficient to affect volume, is fed through C_1 to a rectifier which produces across R_1 a positive bias, acting in opposition to the fixed-negative bias. This positive bias rises on a loud signal, producing the desired increase in anode current, but not more than is necessary for distortionless amplification.

The other components, C_2 and R_2, form a decoupling filter, preventing L.F. interaction between grid and anode circuits. Thus the only parts required other than the rectifier are two fixed condensers and two resistors, all of which you are almost sure to have lying about.

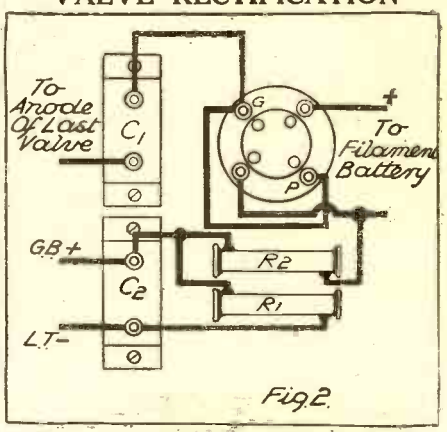
For the rectifier you can use a Westector, but why not save expense and use one of your old valves? Practically any type will serve, but as the filament supply must be quite separate from that of the receiver, choose a low-consumption type.

The old ·06 dull emitters are ideal for this circuit, as they can be fed from a dry cell, while a 2-volt valve can be run from your spare accumulator. The advantages of the system are such that the purchase of a small, cheap accumulator for the rectifier valve can be recommended.

If you can't find room on the receiver baseboard for the battery economiser components you can make them up into a small, compact unit, as depicted in Fig. 2. The condenser values are not critical—·1 mfd or ·25 mfd for C_1 and anything from ·1 mfd upwards for C_2.

It is very important, however, that the insulation of C_1 be above suspicion. The resistor R_2 should not be less than 100,000 ohms or more than 250,000; start with 200,000 ohms for R_2 and 50,000 for R_1, which will suit most valves.

VALVE RECTIFICATION



How a valve can be employed to replace the dry rectifier shown in Fig. 1.

The amount of positive "back-bias" depends largely on the resistance of R_1, so that some experiment with different resistors may be necessary. Reduce R_1 as far as you can before distortion becomes noticeable, a good idea being to use a variable resistor for R_1.

A similarly arranged scheme could also be devised for A.V.C., using an old valve as rectifier.

CURING BREAK-THROUGH ON LONG WAVES

TO prevent medium waves breaking through on the lower long-wave readings it is customary to put a ·0003-mfd. condenser across the aerial coil: across the long-wave section only, to save switching it out when tuning medium waves.

I have noticed, however, that this is not always suitable. In my case the capacity needs to be ·0001. So try different values if you are troubled.

A medium wavetrap in series between terminal A and the aerial coil can be fairly effective also, and this method has the advantage of allowing you to tune down as low as before.

An Interesting Variation.

What has been engrossing me, though, is a curious variation of the former device. Across aerial and earth I put a ·001 condenser. Then between terminal A and the start of the aerial windings on the coil I put a ·00075 variable. Not only is break-through thus eliminated, but there is a decided means of selectivity on the long waves themselves.

Expect plenty of shift on the lower readings as you tune. The more you increase the variable condenser capacity the more the positions will vary on the dial. **E. E.**

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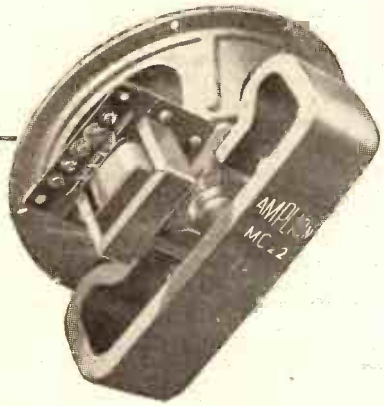

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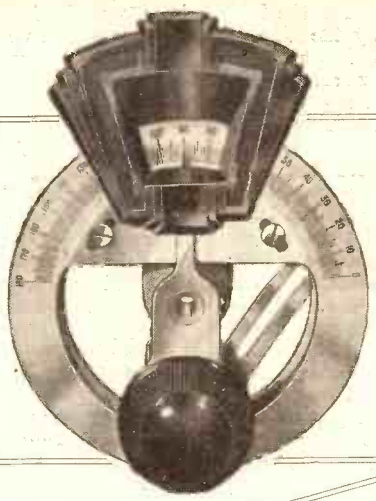

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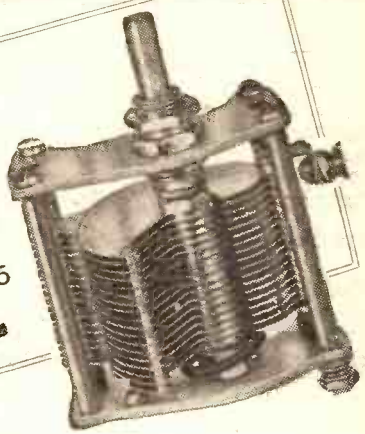

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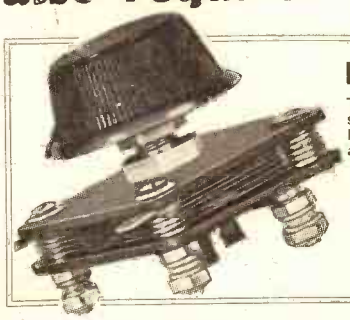

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STATIONS WORTH HEARING

A résumé of recent listening conditions on the broadcast wavebands, with special reference to the wavelength problems of the European stations between 1000 and 2000 metres.

By R. W. HALLOWS, M.A.

THOUGH the new scheme for the long wave band suggested by the Geneva meeting of the U.I.R. has not yet been officially accepted by all of the countries concerned, a good many wavelength changes have been made by long-wave stations since I last wrote, and, generally speaking, these have had good effects.

If the new scheme is adopted the long-wave band will extend up to 1,948 metres instead of 1,875 metres. This very long wavelength is assigned to Kaunas, and if it is adopted it is possible that this station—a 7-kilowatter—may be quite well heard over here. It is proposed that Huizen, which was discontented with the 1,345-metre wavelength allotted to it under the Lucerne Plan, should go to 1,886 metres. This arrangement should prove satisfactory to the Dutch authorities, for 1,886 metres should be even more favourable for long range than the 1,875 to which the station has clung so tenaciously.

Luxembourg is at last to be recognised and to have an official wavelength of 1,304 metres. The Eiffel Tower disappears altogether from the long waves, since the French Government has undertaken to make it shortly a medium-wave station.

The Tangle Above 1,000 Metres.

The countries responsible for most of the trouble on the long waves are Russia, Sweden and Poland, which between them have four "wandering" stations—Minsk, Kharkov, Motala and Warsaw. The Conference decided not to allot a particular wavelength to each of these stations, but to hand over four channels to the countries concerned, leaving them to fight it out between themselves. These wavelengths are 1,365, 1,389, 1,442 and 1,796 metres. Everybody is sure to try to grab the longest wavelength. It will probably be seized by the station which gets there first and has the loudest voice!

One hopes sincerely that the scheme will go through, for it would probably straighten out such tangles as still remain on the long waves. It must, though, be remembered that it can at best be only a temporary measure, for there are several other long-wave stations projected or building which have been authorised by the Lucerne Conference. Amongst them are Madrid and proposed stations in Syria and North Portugal. When these come into operation a further reshuffle may become necessary.

Those Mystery Heterodynes.

Present conditions on the long waves are a considerable improvement upon those prevailing a month ago. Huizen is now free of the background interference which used to spoil its transmissions so frequently; Radio-Paris has adopted a wavelength of 1,648 metres, and by doing so has got rid of the incessant heterodyne from which it suffered for over a month after the inauguration of the Lucerne scheme. Zeesen is also perfectly clear, and Motala often comes through well. Warsaw, however, is frequently heterodyned. Luxembourg is completely reliable at all times, and both Kalundborg and Oslo are often good.

There has been one very interesting phenomenon on the medium waves at intervals during the past few weeks. Certain stations below 300 metres were suffering from heterodynes, particularly after about ten o'clock in the evening. The monthly wavelength reports of the U.I.R. disclosed no European stations working on wavelengths that could cause these whistles.

Caused by An American Station!

Like many others, I was much puzzled over this. I suspected that harmonics of long-wave stations might be responsible, but there seemed to be none that fitted in.

The solution of the mystery came with startling unexpectedness. I was using one night a receiving set of an experimental kind which had been specially made to obtain selectivity of a far higher order than is usual in broadcast receivers, even of the superheterodyne type. At the time there was a strong heterodyne on Hilversum from a station that was working obviously very close to its wavelength of 301·5 metres.

By hairbreadth tuning I managed to separate the offending station from Hilversum, but for a long time it was impossible to discover what it was, for, as I have said, the set was but an experimental one, and in its then condition good quality was not obtainable when selectivity was at its highest.

Trouble from High Power?

At length I did receive the call-sign—WBZ, of Springfield, Massachusetts, U.S.A.!

This station, which is rated at 25 kilowatts, operates on a wavelength of 302·2 metres, and in frequency it is separated by less than 5 kilocycles from Hilversum. It was coming through particularly strongly at the time—strongly enough to cause a heterodyne at a range of over 3,000 miles.

Since then other listeners and myself have identified on various evenings several American stations at hours between 10 p.m. and midnight. Some were hardly strong enough to cause audible heterodynes; others unquestionably did so.

As several American stations are considerably increasing their power this summer, the long-distance heterodyne may become something of a nuisance next autumn.

Some Good Alternatives.

Comparatively few changes have occurred on the medium wavelengths, though several heterodynes that were in existence a month ago have been cleared up. This is due partly to better wavelength keeping on the part of stations as a whole and partly to the bringing to book of some of the smaller fry which were wandering off their proper group wavelengths and causing a good deal of trouble.

One of the worst affected stations during the first two months of the Lucerne Plan's existence was Leipzig, which was almost invariably heterodyned. There are signs that an improvement is taking place here, for on several evenings prior to the writing of these notes I have had Leipzig strongly and clearly.

Milan also is now rarely heterodyned, whilst Berlin has been quite free from this trouble for some little time. Hilversum is no longer suffering from the long-range or any other heterodyne, and the Poste Parisien is now very rarely interfered with. An interesting station is Heilsberg, which is generally perfectly clear until about nine o'clock at night, after which time a piercing whistle develops. This heterodyne is *not* of transatlantic origin. It is due to the fact that the Spaniards and the Portuguese go in for very late evenings. Their stations don't, as a rule, start regular programmes until about nine o'clock, but once they have got under way they continue until all hours of the morning.

The Best Wavelengths.

Heilsberg's late evening heterodyne is due to Barcelona E A J 15, which has the unenviable distinction of never having used the same wavelength on any two nights during the past month! This seems rather a shame, for Heilsberg is one of Europe's best-behaved stations, keeping exactly to its prescribed wavelength.

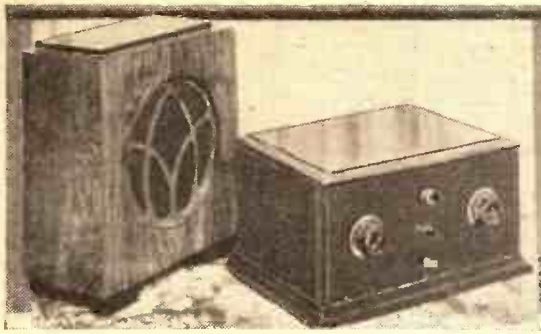
The best part of the medium-wave band is still that above 300 metres, and the cream of this is the "belt" between 400 and 550 metres.

In this comparatively narrow belt there are no less than fifteen stations which can be received evening after evening with certainty at full loudspeaker strength and with no heterodyne interference. These are Munich, Rome, Stockholm, Paris P T T, Sottens, Langenberg, Lyons P T T, Prague, Brussels No. 1, Florence, Vienna, Stuttgart, Athlone, Beromünster and Budapest.

Were there nothing else to choose from, these alone would provide the listener with a magnificent selection of programmes.

BUTTONHOLING "MIKE"

M. Alex Virot, the well-known French "running commentator," wearing in his buttonhole the smallest microphone ever used for an outdoor broadcast. The occasion was the famous six days cycle race at the Paris Velodrome d'Hiver.



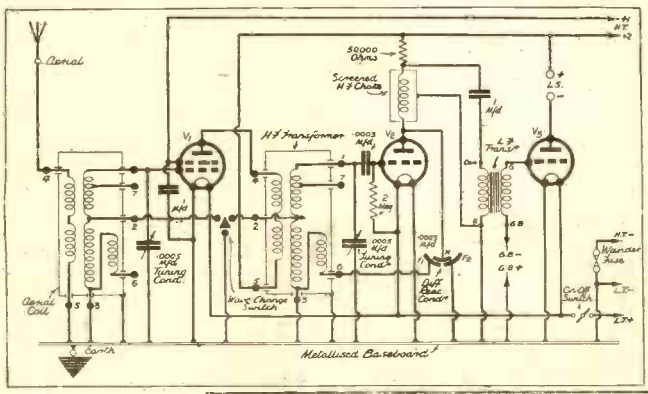
The NEW "EVERYBODY'S THREE"

Separately tuned stages precede the S.G. and detector valves in this design, whilst a shunt-fed L.F. transformer constitutes the coupling between the detector and output valves. The set also features the new Wearite Universal coils, cumulative grid detection, differential reaction and simplified wave-change switching.

LAST week we announced the coming of the New "Everybody's Three" and gave the reason for its construction—namely, selectivity.

There are thousands of listeners and would-be listeners who live almost in the shadow of a powerful transmitter—Brookmans Park, Moorside Edge, Falkirk and so on. They like the local programmes sometimes, but, like the rest of the country, they want to get something other than that ladled out to them by the B.B.C. And they want to get it without having to indulge in an expensive receiver.

You cannot get a great deal of what you want in the world without paying for it. That is a fact that is generally recognised. To pick up the full number of European stations without fail means a really expensive set, even in these days of radio wizardry, and even with such a receiver it is doubtful if the performance could be guaranteed. Such a set is beyond the means of most of us—even if we want so high a performance. As a matter of fact, probably very few really want so sensitive and selective a receiver; they may consider that its capabilities are the perfect ideal, but contemplation would immediately show that such an ideal is not by any means necessary to one's radio happiness, and that, after the first glow of ownership, the full powers of such a set would rarely, if ever, be used.



The diagram above shows the full circuit details, and makes clear the method of connecting the new coil units.

Cutting Out the Local.

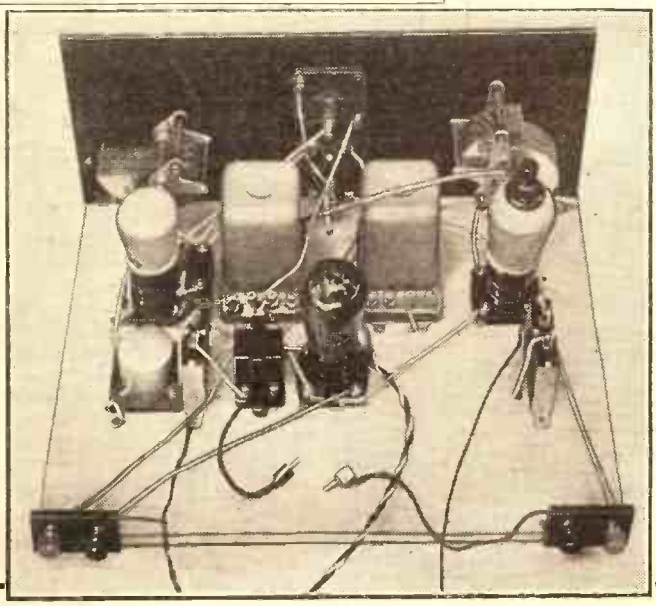
What the average home constructor requires is a set that will enable him to cut out the locals without much trouble in favour of some of the chief continentals. He does not want all the Continent, with its unending relays of the same programme, and what he demands as much as performance is inexpensiveness.

It was to satisfy such requirements that Wright & Weaire, Ltd., designed their new "Universal" coil. They realised that selectivity and inexpensiveness do not usually walk hand in hand, so they set out to design a coil that would allow really sharp tuning to be obtained without high price. Let the makers tell their story in their own words:

"Why should there be any greater need for selectivity under the present Lucerne Plan than there was under the Prague Plan which it has replaced? So far as the medium waves are concerned, both are based on a 9-kilocycle separation between stations as the minimum. So far so good; but there are other considerations.

Wavelength Wandering.

"Under the Prague Plan many stations failed to keep their wavelength, with the result that they heterodyned and were heterodyned by those on neighbouring channels. Amongst the worst offenders were the stations that were nominally using a common wavelength. In many instances these theoretical common wavelengths became wavebands many kilocycles in width.



There is room on the baseboard for the 9-volt G.B. battery.

"Under the Lucerne Plan the countries of Europe have agreed that wavelength wandering shall cease. Stations with individual wavelengths may not deviate from their proper frequency by more than 50 cycles. This is also the largest deviation allowed on any kind of common wavelength, whilst upon certain shared and common

(*Continued on next page.*)

COMPONENTS REQUIRED

2 Wearite Universal screened coils.
2 British Radiogram No. 32 ·0005-mfd. tuning condensers, or Polar, Utility, Ormond.
1 Graham Farish ·0003-mfd. differential reaction condenser, or J.B., Polar, Telsen, British Radiogram.
1 W.B. 2-point push-pull on-off switch, or Benjamin, Bulgin, Telsen, Wearite.
1 Wearite type G.W.C. 3-point push-pull wave-change switch.
3 Benjamin 4-pin valve holders (Vibrolder type), or W.B., Telsen.
1 T.M.C. Hydra 1-mfd. fixed condenser, type 25, or T.C.C., Dubilier, Graham Farish, Telsen, British Radiogram.
1 T.M.C. Hydra ·1-mfd. fixed condenser, type 25, or Dubilier, T.C.C., Telsen.
1 Dubilier ·0003-mfd. fixed condenser, type 620, or T.C.C., Graham Farish, Telsen.
1 Erie 2-meg. grid leak, 1-watt type, with wire ends, or Dubilier, Varley, Bulgin.
1 Erie 50,000-ohm resistance, 1-watt type, with wire ends, or Bulgin, Dubilier, Varley.
1 Graham Farish screened H.F. choke, type H.M.S., or Bulgin, Telsen, Wearite.
1 Bulgin L.F. transformer, type L.F.12, or Varley, Ferranti, R.I.
4 Bulgin indicating terminals, or Belling-Lee, Clix.
1 Peto-Scott panel, 14 in. x 7 in., or Becol, Permcol, Goltone.
1 Peto-Scott Metaplex baseboard, 14 in. × 10 in.
2 Peto-Scott terminal strips, 2 in. × 1½ in., or Permcol, Becol, Goltone.
4 Clix wander-plugs, or Belling-Lee, Eelex.
1 Belling-Lee Wander-fuse.
1 Belling-Lee anode connector, or Clix, Eelex.
2 Clix accumulator spades, or Belling-Lee, Eelex.
1 Coil B.R.G. Quikon Wire.

THE NEW "EVERYBODY'S THREE"

(Continued from previous page.)

wavelengths the greatest permissible departure from the correct frequency is but 10 cycles.

"Compare these figures with the published lists of deviations under the old Prague Plan. Such lists contained only those stations which deviated by more than 1·9 *kilo*cycles, or 1,900 cycles from their allotted frequencies; yet numerous stations were included in it each week.

ACCESSORIES RECOMMENDED

LOUDSPEAKER: Amplion M.C.44, W. B., Celestion, R. & A., Rola, Marconiphone, Blue Spot, Atlas, Ferranti, G.E.C., Ormond.
BATTERIES: H.T. 120 volts: Siemens, Lissen, Pertrix, Drydex, Ever Ready, Ediswan, Marconiphone, G.E.C., Hellesens, or Block H.T. accumulators.
G.B. 9 volts: Drydex, Hellesens, G.E.C., Marconiphone, Siemens, Lissen, Pertrix, Ever Ready, Ediswan.
L.T. 2 volts: Block, Lissen, Exide, Pertrix, Ediswan.

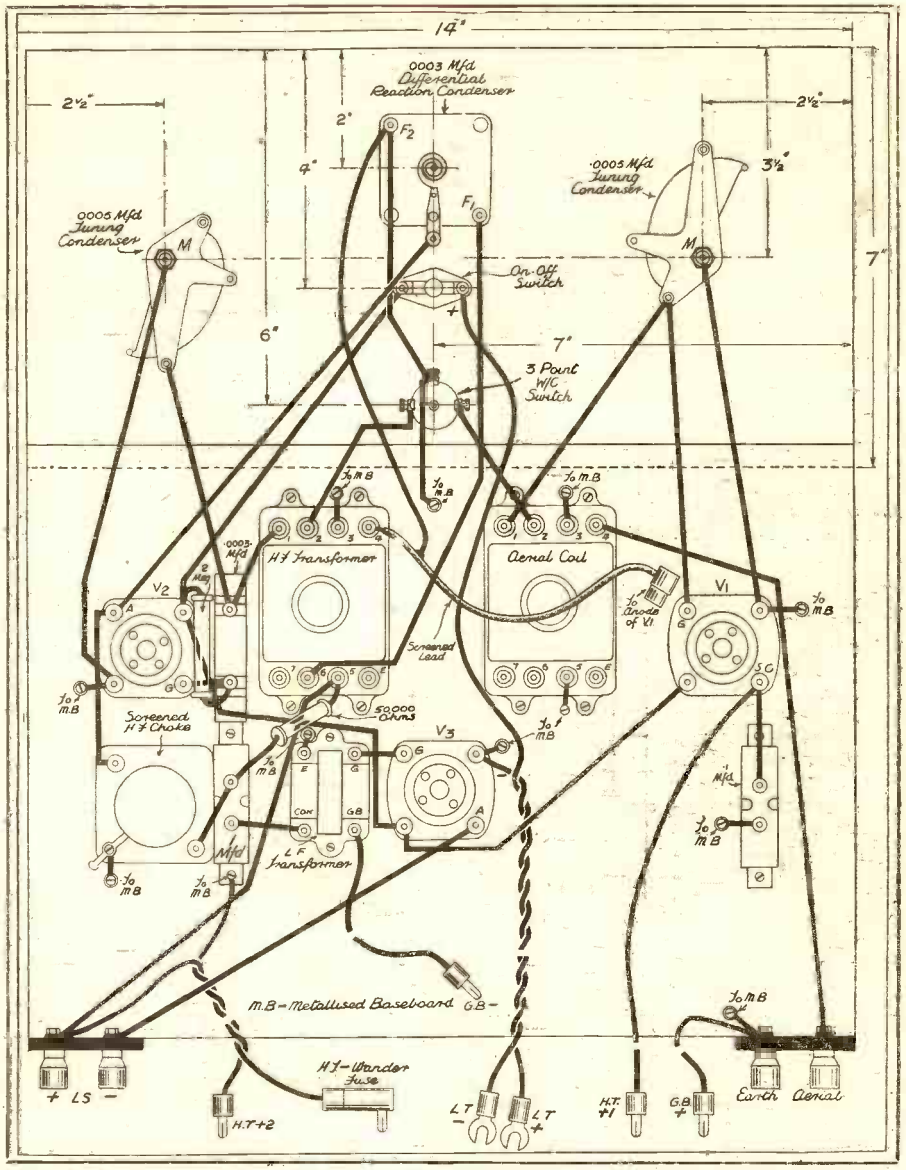
"The result of the far closer adherence to correct frequency demanded by the Lucerne Plan is that a much greater number of foreign stations are receivable by the set which possesses a reasonably good degree of selectivity.

Increases in Power.

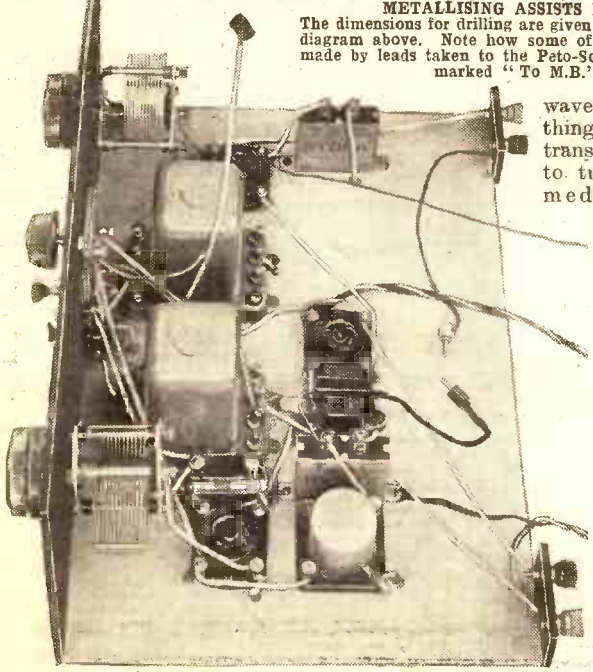
"There is a second and possibly even more cogent reason why selectivity has now become of paramount importance. Enormous increases in power have taken place in some of the continental transmitters, and many more are to multiply their power threefold, fivefold or tenfold within the next few months.

"Even a not very selective set may be able to separate two comparatively low-powered foreign stations working upon adjacent wavelengths. It is a very different thing to separate two high-powered transmissions, and more difficult still to tune in, clear of interference, a medium-powered station which has a high-powered next-door neighbour, or possibly two such neighbours, one on either side.

"Many set users will find that their existing apparatus is inadequate for the new conditions. It is to meet these conditions and to save the listener from the necessity of completely rebuilding his set that Wright & Weaire, Ltd., the senior firm in the wireless components industry, have designed their Universal coil. It is called universal because it can be employed as a single aerial tuner or in double harness as a band-pass unit; it will act with equal efficiency as a high-frequency transformer, following plain screen-grid or variable-mu valves."



METALLISING ASSISTS EASY CONSTRUCTION.
The dimensions for drilling are given on the combined panel-and-wiring diagram above. Note how some of the connections to "earth" are made by leads taken to the Peto-Scott Metaplex baseboard—they are marked "To M.B." in the diagram.



Two Tuned Stages.

Such, then, is the story behind the coils used in the New "Everybody's Three." The receiver consists of two tuned stages, making full use of the selectivity afforded

(Continued on page 125.)

THE S.G., DET. AND L.F. VALVES TO CHOOSE

Make.	S.G.	Det.	Output
Cossor	220S.G.	210H.F.	220P.A.
Mullard	P.M.12A.	P.M.1H.L.	P.M.2A.
Mazda	215S.G.	H.L.2	P.220
Marconi	S.22	H.L.2	L.P.2
Osram	S.22	H.L.2	L.P.2
Tungsram	S.210	H.R.210	—
Hivac	S.G.220	H.210	—
Dario	T.B.422	T.B.282	T.B.122

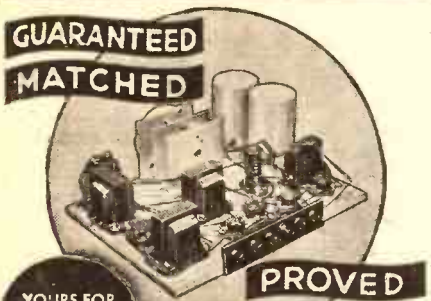
NEW EVERYBODY'S THREE
THE CONTRA-PHASE FOUR
PILOT AUTHOR KIT
EXACT TO SPECIFICATION

The Pilot Kit SERVICE was founded in 1919.

See the PILOT on the carton. It's a real guarantee.

IMPORTANT **Miscellaneous Components,** *Parts, Kits, Finished Receivers or Accessories for Cash, C.O.D. or H.P. on our own system of Easy Payments. Send us a list of your wants. We will quote you by return. C.O.D. orders value over 10/- sent carriage and post charges paid (GREAT BRITAIN ONLY). OVERSEAS CUSTOMERS CAN SEND TO US WITH CONFIDENCE. We carry a special export staff and save all delay. We pay half carriage—packed free. Send full value plus sufficient far half carriage. Any surplus refunded immediately.* **Hire Purchase Terms are NOT available to Irish or Overseas customers.**

PILOT CLASS "B" FOUR KIT



Another **PETO-SCOTT** triumph—this latest Class B Battery 4 Kit at a popular price. Seven times the volume of an ordinary battery set, with outstanding performance equal to "mains" receiver. Kits supplied with detailed "Simple to build" instructions and assembly blue print. Matched and tested components. Guaranteed for 12 months by Peto-Scott. **KIT "A"** less Valves and Cabinet. Cash or C.O.D. Carriage Paid, £3/10/0, or 5/- deposit, balance in 12 monthly payments of 6/-.

KIT "B."—As Kit "A," but including 4 matched and tested Valves. Cash or C.O.D. Carriage Paid, £5/2/6, or 12 monthly payments of 9/6.

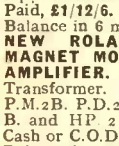
KIT "C."—As Kit "A," but including 4 matched and tested Valves and Peto-Scott Consolette Cabinet. Cash or C.O.D. Carriage Paid, £5/15/0, or 12 monthly payments of 10/6.

Recommended **PETO-SCOTT SPEAKER,** if required, add 22/6 to Cash Prices or 2/- to each monthly payment.

NEW BLUE SPOT 29 P.M. PERMANENT MAGNET MOVING-COIL SPEAKER. With input transformer. Cash or C.O.D. Carriage Paid, £1/12/6. Balance in 6 monthly payments of 5/-. Send 5/- only

NEW ROLA CLASS B PERMANENT MAGNET MOVING-COIL SPEAKER AND AMPLIFIER. Complete with valve and input Transformer. Two Models "A" for P.M.2B. P.D.220 and 220 B. "B" for 240 B. and HP 2 (state which when ordering). Cash or C.O.D. Carriage Paid, £3/11/0. Balance in 11 monthly payments of 6/6. Send 6/6 only

---PETO-SCOTT PERMANENT MAGNET---MOVING-COIL SPEAKER



Power and Pentode Output. Complete with input transformer. Send only 2/6; balance in 5 monthly payments of 4/-. Cash or C.O.D. Carr. Paid, 19/6.

2/6 DOWN.

NEW GARRARD MODEL 202A. 12-in. Turntable. Electric Motor for A.C. mains. Cash or C.O.D. Carriage Paid, £2/10/0. Balance in 8 monthly payments of 6/-. Send 6/- only

ATLAS C.A.25, for Mains, Class B and Q.P.P. four tappings; 60/80, 50/90, 120, 150. 25 m/A. Cash or C.O.D. Carriage Paid, £2/19/6. Balance in 10 monthly payments of 6/-. Send 6/- only

J. B. LINACORE. Complete tuning unit comprising matched coils, condenser, type BPB (battery) type BPM (mains). Cash or C.O.D. Carriage Paid. £3/9/6. Balance in 11 monthly payments of 6/6. Send 6/- only

NEW EVERYBODY'S THREE

KIT "A" Author's Kit of First Specified Parts, including Ready-drilled Panel, Baseboard and Terminal Strips, but less Valves and Cabinet. Cash or C.O.D. Carriage Paid £2-15-0 or 12 monthly payments of 5/-.

KIT "B" As for Kit "A," but with Set of Specified Valves only. Cash or C.O.D. Carriage Paid, £4/6/3, or 12 monthly payments of 8/-.

KIT "C" As for Kit "A," but with Valves and PETO-SCOTT Universal Table Cabinet. Cash or C.O.D. Carriage Paid, £5/1/3, or 12 monthly payments of 9/3.

KIT-BITS You pay the Postman. We pay post charges on all orders over 10/- GREAT BRITAIN ONLY.

	£	s.	d.
1 Peto-Scott METAPLEX Baseboard, 14" × 10"		1	9
1 Peto-Scott Ready-drilled Panel, 14" × 7"		4	0
1 Set of Specified Valves	1	11	3
1 Peto-Scott Universal Table Cabinet		15	0
2 Wearite Universal Screened Coils		10	0
2 British Radiogram No. 32 ·0005-mfd. Condensers		12	0
1 Bulgin L.F.12 Transformer		6	0

S.T. 500

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen Class B Output Choke, Peto-Scott "Metaplex" Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy of "Popular Wireless" Oct. 21st. Cash or C.O.D. Carriage Paid. £5-5-0 *or 12 monthly payments of 9/6*

KIT "B" As Kit "A," but including 4 Specified Valves. Cash or C.O.D. Carriage Paid, £7-10-3 *or 12 monthly payments of 13/9.*

KIT "CT" As Kit "B," but including Peto-Scott Specified Walnut Table Cabinet. Cash or C.O.D. Carriage Paid, £8-9-9 *or 12 monthly payments of 15/6.*

KIT "CC" As Kit "B," including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker. Cash or C.O.D. Carriage Paid ... £8-19-9 *Or 12 monthly payments of 16/3*

If Peto-Scott Permanent Magnet Speaker required add 19/6 to Cash Price or add 1/9 to each monthly payment.

CONTRA-PHASE 4

KIT "A" Author's Kit of First Specified Parts including Ready-drilled Panel, METAPLEX Chassis, and Westector, but less Valves and Cabinet. Cash or C.O.D. Carriage Paid £6-2-6 or 12 monthly payments of 11/3.

KIT "B" As for Kit "A," but with Valves only. Cash or C.O.D. Carriage Paid, £8/7/9, or 12 monthly payments of 15/3.

KIT "C" As for Kit "A," but with Valves and Peto-Scott American type Table Cabinet. Cash or C.O.D. Carriage Paid, £9/2/9, or 12 monthly Payments of 16/9.

KIT-BITS You pay the Postman We pay post charges on all orders over 10/- GREAT BRITAIN ONLY.

	£	s.	d.
1 J.B. Unitune Condenser 2-gang, ·0005-mfd.		17	6
1 Lissen 2-gang Coil Unit, type L.N. 5161, with on-off switch		17	6
1 R.I. Hypermite L.F. Transformer		12	6
1 Igranic Class B Driver Transformer		11	6
1 B.R.G. Class B Output Choke		6	0
1 Peto-Scott Metaplex Chassis, 12" × 10" × 2½"		3	6
1 Set of 3 Specified Valves	2	5	3
1 Peto-Scott American type Cabinet		15	0

BIFOCAL THREE

KIT "A" Author's Kit of First Specified Parts, including Ready-drilled Panel, Baseboard and Westector, but less Valves and Cabinet. Cash or C.O.D. Carriage Paid £5-15-0 or 12 monthly payments of 10/6.

KIT "B" As for Kit "A," but with Valves only. Cash or C.O.D. Carriage Paid, £7/14/0, or 12 monthly payments of 14/-.

KIT "C" As for Kit "A," but with Valves and Peto-Scott Cabinet. Cash or C.O.D. Carriage Paid, £8/11/6, or 12 monthly payments of 15/9.

ECKERSLEY NATIONAL 3

KIT "A" Author's Kit of First Specified Parts, including **READY-DRILLED PANEL** and **METAPLEX** chassis assembly, but less valves and cabinet. Cash or C.O.D. Carriage Paid ... £5-10-0 or 12 monthly payments of 10/-.

KIT "B" As Kit "A," but including set of Specified Valves, but less cabinet. Cash or C.O.D. Carriage Paid, £7/9/0, or 12 monthly payments of 13/9.

KIT "C" As Kit "A," but including Valves and Table Cabinet. Cash or C.O.D. Carriage Paid, £8/6/6, or 12 monthly payments of 15/3.

ALL THE RAGE GIVES SEVEN TIMES THE VOLUME

PILOT CLASS "B" SPEAKER AMPLIFIER

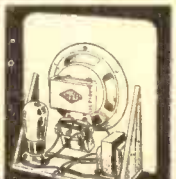
SUITABLE FOR ANY BATTERY SET Without Class B Amplification your present Battery Set is obsolete. Realising this, we have produced this marvellous, self-contained Unit, comprising guaranteed Peto-Scott Class B Moving-Coil Speaker, Class B Transformer, B.V.A. Class B Valve. Gives 7 times the Volume . . . with mains quality and power. Low H.T. consumption. SIMPLE TO CONNECT. JUST PLUG-IN the amazing 5-WAY Automatic Connector.

SIMPLY PLUGS IN TO YOUR PRESENT BATTERY SET

5/- WITH ORDER

Balance payable in 11 monthly payments of 5/6. Carriage Paid.

Cash or C.O.D. **59/6** Carriage Paid.



PETO-SCOTT CO. LTD., 77, CITY ROAD., LONDON, E.C.1. Tel.: Clerkenwell 9406/7.
West End Showrooms: 62, High Holborn, London, W.C.2. Tel.: Holborn 3248.

Dear Sirs,—Please send me CASH/C.O.D./H.P.....

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ADDRESS.....

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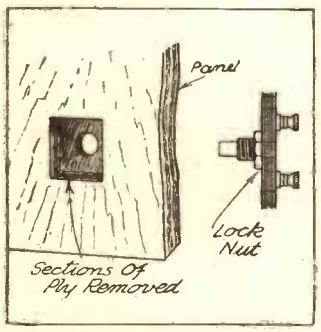
ANY ITEM SUPPLIED SEPARATELY—ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID

Recommended WRINKLES

PANEL-MOUNTING COMPONENTS.

PANEL-MOUNTING components, although quite satisfactory for ¼-in. panels, are not always suitable for a 5-ply panel, owing to the shortness of the threaded bush.

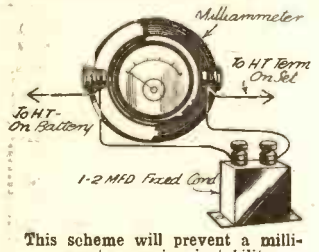


A tip for those who use five-ply wood panels.

Such components, however, are usually provided with a locking nut, and by cutting away two or three layers of the plywood with a sharp wood chisel it is possible to countersink the lock-nut and so bring the threaded bush through sufficiently to enable fixing.

A MILLIAMMETER HINT.

WHEN checking the total anode current of a set by inserting a milliammeter in the H.T. negative lead an incorrect reading may be obtained. This is due to the resistance of the meter causing instability.

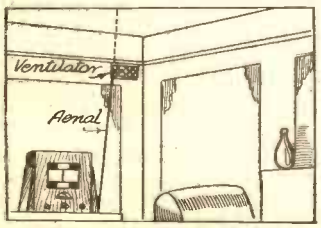


This scheme will prevent a milli-ammeter causing instability.

If a 1- or 2-mfd. condenser is connected across the meter this error should be eliminated and a correct reading obtained.

AN EFFICIENT INDOOR AERIAL.

THE problem of finding an efficient substitute for an outdoor aerial may sometimes be solved with ease where a non-metallic ventilator shaft runs from the roof to the wireless room. Simply drop an insulated wire down the shaft. The extra height may well compensate for capacity to earth. An unused chimney may also be used for the same purpose.



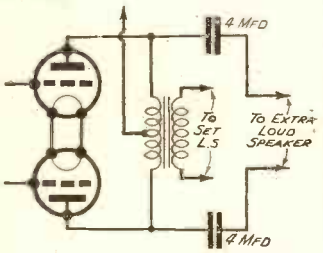
Unsightly wires can be avoided in this manner.

ADDING A LOUDSPEAKER.

LISTENERS who possess a self-contained receiver employing a mains-energised loudspeaker and are desirous of fitting an additional one of the permanent-magnet type sometimes experience difficulty regarding the correct method of connecting.

In practice the above addition is in no way a complicated matter, and only two 4-mfd. condensers—in addition to the extra speaker—are necessary. The wiring is as follows:

A lead is joined from the anode terminal of the output valve to one side of a 4-mfd. condenser, and another lead from the earth line to a terminal on the other 4-mfd. condenser. The remaining terminals on these condensers are connected to the extra loudspeaker.



How to add an extra loudspeaker to a push-pull circuit.

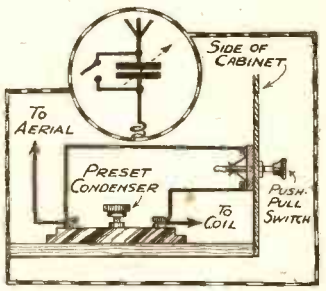
In the event of push-pull output being incorporated, two leads are taken from the two anodes of the valves to a terminal on each of the 4-mfd. condensers, the remaining terminals of which are joined to the additional speaker, as shown in the diagram.

SHORTING A PRESET.

CONSTRUCTORS who experience difficulty in obtaining adequate selectivity on the medium-wave band, due to the close proximity of the local transmitter, very often fit a preset condenser in the aerial lead as a method of remedying the trouble.

This method, although quite satisfactory for its particular purpose, offers a disadvantage in reducing the output of the receiver—especially on the long-wave band; and in some instances where high selectivity is not required on this band it is a good scheme to incorporate a switch of the push-pull type across the condenser, as shown in the diagram.

When the receiver is operating on medium waves the switch can be left open for selectivity purposes, but for long-wave working it can be closed. In this way the condenser can be short-circuited when not required.



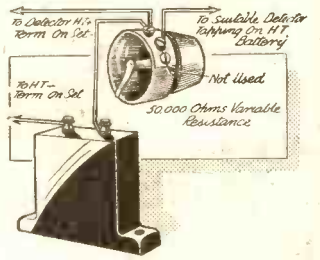
The wiring for a switch to cut out a series-aerial condenser.

IMPROVED SPEAKER ADJUSTMENT.

MANY loudspeaker units have an adjusting screw at the back instead of a knob, and are therefore not so readily adjustable when this is necessary as with the latter type. An improvement can be effected by soldering into the slot of the adjusting screw a short piece of strip brass (say one inch long) of suitable thickness, which can be turned like the winding key of a clock. If necessary, the piece of brass can be shaped in order that the "key" shall not foul other parts of the speaker unit.

AN AUXILIARY REACTION CONTROL.

WITH many short-wave receivers it may be found difficult to obtain sufficiently fine reaction control.


To Detector H.T.+ Term On Set
To Suitable Detector Tapping On H.T. Battery
To H.T.- Term On Set
Not Used
50,000 Ohms Variable Resistance

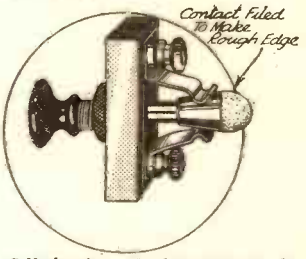
These additional connections do not affect the set's wiring.

If a 50,000-ohms variable resistance is placed in series with the detector H.T.+ lead, a 1-mfd. fixed condenser being connected from the end of the variable resistance nearest the set to H.T.– the above trouble can be overcome.

The ordinary reaction control of the set should be used to obtain a rough setting. The variable resistance can then be used as an auxiliary vernier control.

BETTER SWITCH CONTACTS.

EVERY wireless constructor has at some time or other had a lot of trouble through the contacts of a switch getting dirty. The sketch below shows my idea of a self-cleaning switch. I have made my own switches for the "S.T.400" like this and found them very successful.



Self-cleaning of the contacts is assured by the roughened surface.

HOW MANY TURNS?

MANY readers no doubt use the hand-drill for winding chokes, etc., but probably it is not generally known that, instead of counting the revolutions of the drill chuck, the revolutions of the hand-wheel may be counted by first using the following formula, which does away with over fifty per cent of the counting:

First divide the number of teeth of the small wheel into the number of teeth of the hand-wheel, and divide the result into the number of turns required, which will give the number of turns of the hand-wheel. Example:

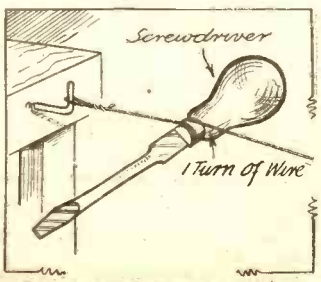
Hand-wheel, 40 teeth.
Small wheel, 10 ,,
2,000 = number of turns required.

Therefore $\frac{2,000}{40 \div 10} = 500$ revolutions.

STRAIGHTENING WIRE.

THE following is a quick way of getting the kinks out of wire.

First fix one end of the wire to a suitable support. Then twist the wire once round the round part of a screwdriver. Draw the screwdriver slowly down the wire, keeping both ends taut, and a straight length will result.



Even bad kinks are removed from wire in this way.

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others published will be paid for at our usual rates.

Each hint must be on a separate piece of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

The best Wrinkle in the issue dated March 31st was sent by Mr. C. E. Rowe, Ivinghoe, Aston, Leighton Buzzard, Beds., to whom a guinea is being awarded.

IF your set crackles and bangs like a friendly argument in Chicago

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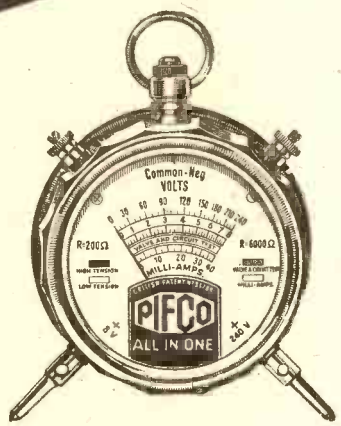

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● **PIFCO ROTAMETER** *(right). A radio testing instrument on entirely new principles. One needle operates on 8 separate dials. For electric or battery sets. Amazingly handy and accurate. No other instrument in the world like it. In black bakelite, complete with leads. Price* **29/6.**

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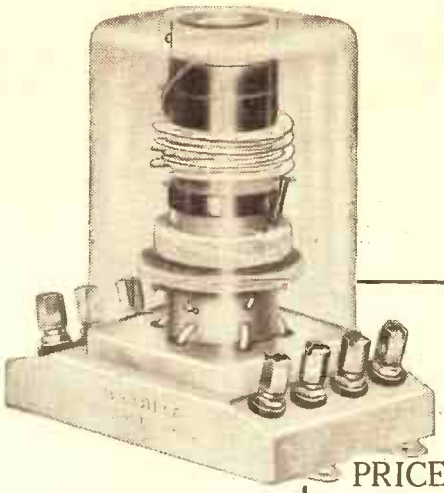

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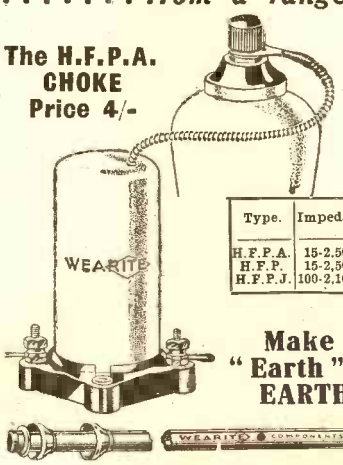

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H.F.P.J.	100-2,100m.	7mmfd.	220,000mh.	770 ohms.	2/-

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TESTED AND FOUND-?

Being Leaves from the Technical Editor's Notebook

THE LATEST WESTECTOR

THE introduction of the Westector by the Westinghouse Brake and Saxby Signal Co., Ltd., of 82, York Rd., King's Cross, London, N.1., was one of the most important radio events of recent times.

This inexpensive and practically everlasting little device has been styled the "cold valve," and that is hardly an exaggeration, for it does very efficiently take the place of a valve for many purposes.

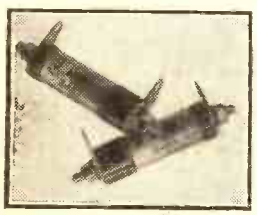
Recently a quite new Westector has been produced, and I do not think I can do better than quote the excellently descriptive words of the manufacturers themselves by way of an introduction. They say:

"The metal rectifier, as a means of rectifying alternating currents, has become well established during the past five years, but it has only been during the past year that the difficulties associated with the rectification of radio frequencies has been overcome.

Result of Research.

"The chief difficulty was one of capacity due to the large area of rectifying element, and until it was possible to prepare a rectifier of small dimensions nothing practical could be offered. In early 1933 it was found possible to prepare discs of sufficiently low effective capacity to render them a practical proposition when used at intermediate frequencies, and the now well-known Westector type W was placed on the market. Their merits as a second detector in a superheterodyne receiver were rapidly recognised, and during the season of 1933 the Westector, as a detector and asymmetric conductor, became very popular.

"It was, however, recognised that these units, though still functioning perfectly as rectifiers, failed to be practical at frequencies higher than 100–200 kilocycles, on account of the heavy damping thrown on the circuit. Work has therefore proceeded on the lines of making still smaller rectifiers with smaller effective capacity. This research has culminated in the production of a new type of Westector—type



The Westector, despite its varied uses, is no larger than an ordinary grid leak.

WX—which has a considerably smaller capacity, enabling it to be used satisfactorily up to frequencies of the order of 1,500 kilocycles.

"Experience with the previous type of Westector has shown that the most satisfactory circuit in which to use the rectifier is the half-wave circuit.

"The WX rectifier has high impedance and is capable of passing 0·1 milliamps mean forward current; a high load resistance of 250,000 or 500,000 ohms is therefore advised. The voltages which can be supplied will be 30–40 volts in the case of the WX6.

"The D.C. static characteristic is linear from 2 volts upwards. There is no upper limit to the characteristic; the only limitation is due to the risk of damage arising from sustained overload. Should the input to the rectifier be of very low value, then it may be preferable to bias the unit to a point of optimum rectification.

Has Many Applications.

"The self-capacity of a rectifier consists of a capacity acting during the reverse half-cycle. During this period it takes a charge, and during the forward half-cycle this charge is short-circuited. The result of this capacity is revealed as a detuning of the resonant circuit by some 5–6 micro-microfarads and a damping of the circuit due to losses. The value of this damping, due to the WX, operated at high frequencies, is sufficiently low to permit circuits of high input impedances to be designed."

Among the many applications of the new WX6 Westector, as it is styled, are those of detector in straight and reflex circuits, as first or second detector in superheterodyne arrangements, and, of course, for many and various A.V.C. and H.T. economy schemes.

The WX6 is no larger than the existing type: it is about the same size as a grid leak! There are no adjustments in it to be made; so even on that score, quite apart from its technical characteristics, it must not be compared with the crystal detector.

The Westector, as such, is a new development altogether, and it is rapidly finding for itself a very concrete position in modern radio technique.

We have already applied the new WX6 to various purposes and have found it efficient and reliable, each individual sample consistently maintaining the characteristics published by the manufacturers.

Those readers who desire to know more about this intriguing device should write to the above address for a copy of "The All-Metal Way," which will be sent free to those who mention POPULAR WIRELESS. This book is packed with interesting information and circuits.

NEW FERRANTI CONDENSERS

The name "Ferranti" has always been associated with high-class radio, and their components are designed and manufactured to that standard. But in many instances their productions are, to say the least of it, by no means cheap.

In the circumstances you would not expect them to be. You have to pay for quality just as you have to pay for quantity. And, in my view, money spent in this way is indeed money well spent.

You can purchase an L.F. transformer for a mere two or three shillings. There is a Ferranti L.F. transformer which retails at 17s. 6d. in a set that stands before me as I write. But it is worth that. It so happens that it replaced a very cheap transformer.

The difference in the results given by the set are by no means only theoretical. You can hear it plainly enough. Bass notes that simply were not there before are now present in a clean, full degree.

Now how does all this line up with the fact that Ferranti have just gone into production with a range of low-priced radio components? It would be justifiable to ask if this great firm was now prepared to jettison a proportion of its traditional high technical standards: was, in fact, building down to a price.

How the Price was Lowered.

Fortunately, no such thing has happened. The first of the new Ferranti "low-cost" components reveals the fact that the constructor is to be allowed to save money in another way and not at the expense of technical quality at all.

The components in question are fixed condensers, and there is a range of four paper types. That is, they have paper dielectrics. The range comprises an ·04 mfd., tested at 750 volts for a working D.C. of 375 volts (250 A.C.), and ·02 mfd., ·015 mfd. and ·01 mfd., all tested at no less than 1,500 volts for a D.C. working of 750 volts or an A.C. of 500 volts.

What are the prices of these Ferranti condensers? Perhaps you think 2s. 6d. is the "natural" price in these days of very keen competition. Well, they each retail at the quite surprising figure of 1s. 2d.!

The saving has been effected by the adoption of an ingenious method of construction. Instead of moulded bakelite cases, plated terminals and so on, each condenser is built into a short length of Pertinax tubing. The ends are sealed with a suitable materfal, and wires, long and pliable, are led out for connecting purposes.

Now, I have seen Ferranti wireless apparatus being made in the great Hollinwood factories, watched every minute process in whole chains of manufacture and assembly, and so I can vouch for the attention and care which are bestowed upon it.

Pertinax tubing acts as the casing for these Ferranti condensers, and long wire leads are provided for connecting.

Therefore I think you can take the reliability of these Ferranti condensers for granted. As for their working efficiency, my tests and uses of them amply confirm the specified figures, the capacities of my samples, for example, actually being well within a five per cent tolerance, which, in the conditions, may not be surprising, but is certainly a creditable achievement for any firm able to retail such components at so low a figure.

The address of Ferranti, Ltd., is Hollinwood, Lancashire.

THE LISTENER'S NOTEBOOK

Comment and criticism on recent B.B.C. programmes.

IN broadcasting, "The 12th" has become a significant phrase. Isn't it slightly reminiscent of the old schooldays and of that end-of-term feeling? The big difference between the two, however, is that a broadcasting series allows no holidays, with the result that we get four "12ths" a year instead of three. I am not so sure about the wisdom of this. Holidays are good for us, and just as necessary to listeners as they are to schoolboys.

* * *

Unfortunately, if we take a holiday we miss the first of the new series, which we cannot afford to do, as broadcast series are entities. Moreover, these initial talks are often explanations of the series, designed to afford us a better understanding of them. So we have no alternative but to listen to them.

* * *

The "12th" is an occasion for joy and regret. It is an occasion for joy when we hear the last of a thing that has never been attractive to us, or when something, once attractive, has, by dint of repetition, forfeited some of its attraction.

On the other hand, we feel nothing but regret when an old friend passes.

* * *

Personally, I never allow a series of anything to offend me. An unattractive series I can afford to leave alone, as everyone else can. The only regret I have is that sometimes the time it utilises each week is wasted time to me as far as listening-in is concerned.

Of the series just completed, the "Seven Days' Hard" will be missed most. I presume it will finish with the rest. I've enjoyed every talk, for every speaker has been brilliant, and the variety of topics dealt with as diverse as the speakers themselves. Besides, the manner of these talks has been unique.

Mr. Pewter has also been a great feature of the "term." He will be missed. These two series have certainly made Saturday evening a worth-while evening.

I hope the B.B.C. will continue to recognise that Saturday night occurs only once a week, and that there should be something special for it. Couldn't Mr. A. P. Herbert be induced again to supply the wherewithal for our Saturday night entertainment?

* * *

The Saturday night Variety has made no less a contribution. One of the best features of last "term's" programmes was the Saturday night Variety show. Many listeners liked "In Town To-night." This was, in my opinion, the most promising of them all, but it did not come up to my expectations.

* * *

"Whither Britain?" too, has claimed a number of adherents. Here, again, the contributors have been men (and one woman) of distinction. Though it wasn't their primary purpose, these talks offered some striking contrasts in the manner of speaking. One noticed the tendency of the politicians among them to use platform oratory and not that of the microphone.

(*Continued on page* 124).

HIGH-FREQUENCY CLASS B

INCREASING ECONOMY.

By C. ROBINSON.

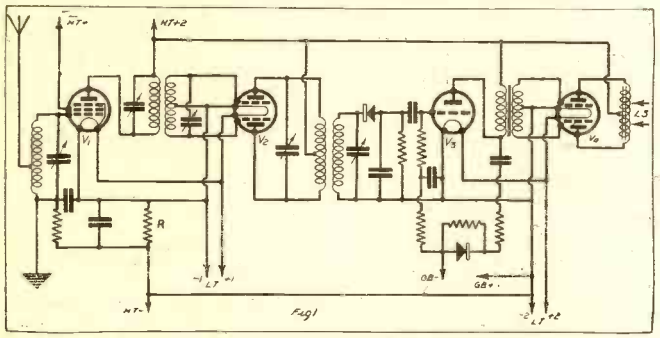
Some interesting suggestions are here made for the use of the well-known Class B valve in a high-frequency capacity. The saving in H.T. consumption, it is claimed, would be very great, and consequently the cost of running a set on these lines would be extremely low.

THE recently introduced H.F. pentode, Class B valve and the Westector offer some fascinating possibilities to the battery-set user.

It is obvious that the ideal battery-operated receiver would be one which is totally quiescent when a programme is not being reproduced, and this ideal can nearly be attained in a Class B set, so far as the driver and Class B valves are concerned.

The Class B output stage is actually a

USING THREE QUIESCENT VALVES



A basic circuit showing the use of a Class B valve as H.F. amplifier following a pentode and also an "economised" Driver feeding into a Class B output.

form of quiescent push-pull, and a Westector can be arranged to control the quiescence of the driver valve.

But it must not be forgotten that the Westector is a very satisfactory diode detector, provided it can be adequately loaded. The trouble is that it is difficult to arrange an entirely satisfactory stage to precede the Westector unless an H.F. pentode is used. This brings us again to the Class B valve, for this also, used as a push-pull H.F. amplifier, would be an excellent way out of this difficulty.

In addition to fully loading the Westector without any risk of the push-pull stage overloading, a very satisfying degree of H.F. amplification could be obtained. Also the anode current of the Class B H.F. valve would be low when no carrier was tuned in.

Automatic Volume Control.

If a signal input were applied to the grids of the Class B H.F. valve the anode current would increase. This increase would depend upon the strength of the carrier. The change of anode current could be utilised to provide automatic volume control, if desired.

A basic circuit incorporating these conceptions is shown in Fig. 1. It will be seen that a variable-mu H.F. pentode (V_1) precedes the Class B push-pull H.F. valve (V_2). The combined anode current of these two valves flows through the resistance R. The voltage developed across R is applied to the control grid of V_1, so providing negative grid bias.

Obviously, when a station is tuned in the Class B valve's anode current will rise, and in turn the voltage across R will increase. This will cause a higher negative bias to be applied to V_1.

This will be recognised as providing the main essential of a "simple" A.V.C. system. The range of A.V.C. could be increased, if desired, by using an additional H.F. pentode preceding V_1.

Applying Bias.

"Delayed" A.V.C. could be obtained by applying a small negative bias to the Class B H.F. valve. The only shortcoming of this part of the circuit is that it necessitates the use of a separate L.T. supply.

High selectivity is assured by the tuned primary tuned secondary "Siamese" H.F. transformers in the Class B H.F. push-pull valve's grid and anode circuits. The inductive coupling between the primary and secondary of each H.F. transformer could be varied to give the required degree of selectivity.

If it were desired to gang the tuning the gang condenser would need to be of a type with separate rotors and stators. There is no reason why the Class B H.F. stage should not be the intermediate frequency stage of a superheterodyne.

In this case the A.V.C. could be applied to a variable-mu H.F. pentode preceding the first detector, or additionally to a pentagrid frequency changer, if desired.

The Westector detector stage is the usual rectifier arrangement, and requires no comment. The driver stage (V_3) is quite normal, except for the automatic quiescence control provided by a Westector. Briefly, this enables a very high negative grid bias to be applied to the driver valve, so reducing the standing, or quiescent, anode current to a fraction of a milliamp.

The Westector in effect applies a positive voltage in opposition to this negative bias in accordance with the L.F. voltage applied to the driver-valve grid. This causes the driver-valve anode current to vary in sympathy with the output volume in a similar manner to a Class B output stage.

A Further Development.

The Class B output valve (V_1) and its associated components are arranged in the conventional manner. A further development might possibly be to eliminate the driver stage, the Westector output being fed directly into the Class B input transformer.

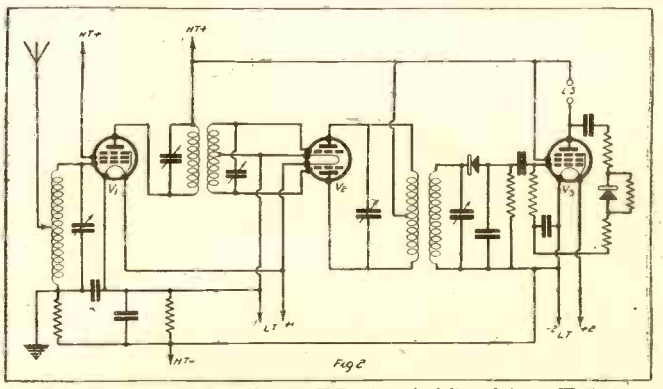
This would involve matching difficulties, but the design of a suitable transformer should be possible. Alternatively, the Westector output could feed a high-efficiency pentode output valve. This would be provided with an H.T. economiser circuit using a Westector.

A circuit on these lines is shown in Fig. 2. So far as the A.V.C. action is concerned, this would possibly be the preferable arrangement. This is because, to give equivalent overall amplification to the first circuit (Fig. 1), it would be necessary to use two H.F. pentodes preceding the Class B H.F. push-pull stage.

This would naturally provide a wider range of A.V.C. action, and also the addition of a tuned circuit would increase selectivity.

At the moment it is difficult to conceive a receiver more closely approaching the completely quiescent set desired nowadays than one incorporating these suggestions.

VERY LOW H.T. CURRENT CONSUMPTION



Another circuit where a Class B H.F. stage is followed by a Westector rectifier and a quiescent pentode output valve.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

WHY IT WAS NECESSARY TO RETRIM.

E. R. H. (Winchester, Hants).—"The fitting of the gramophone switch was a great success, but after a time I had the feeling that the set was not then quite so good on radio as it had been before.

"Concentrating on this, I came to the conclusion that all the distant foreigners were affected to some extent, and then I came across the explanation. The set needed retrimming.

"I am certain I had not moved the trimmers, because they lock; but I found that when one of them had been slackened off a little the set came back to its full distance-smashing performance again.

"Is it usual for the fitting of a gramophone switch to affect trimming? It is certainly a new one on me."

Ideally, the effect should not occur; but in practice some unwanted extra capacity is often thrown across the preceding tuned circuit, due to the self-capacity of the wiring or switch.

In such cases the slackening off of the trimmer for this circuit will often restore the balance. Theoretically, it is better not to have unwanted self-capacity present in stray wiring, but in your case there appears to be no reason why it should not be compensated for in the trimming adjustment as you now have it.

ILLUMINATING THE DIAL.

S. J. I. (London, S.W.3).—"I have recently obtained possession of a two-valve set of amateur make which belonged to an acquaintance who has left this neighbourhood. It is what he called a 'detector-pentode' arrangement, running from the mains (A.C.).

"With this I get excellent reception on an indoor (three-wire) aerial in the roof of the block of flats, of which mine is the top. (In fact, the quality, tone and strength are above anything I have heard in the two-valve class, and a good 50 per cent better than many of the three-valve sets which appear to be the most popular in this district.)

"There is only one small superiority which these sets have over mine, and that is in the matter of an illuminated scale. Although mine, like these others, has a white, transparent dial-face moving behind a kind of window, it is not lit from behind.

"It happens to be placed in a somewhat dark corner of the room, so illumination would be very welcome; and now I have been told that such illumination is obtainable merely by fitting a bulb of the kind used in flash-lamps to the terminals marked "F" on the nearest valve holder.

"Please advise me as to whether this is practicable, and how the job should be tackled if you think a novice is capable of making a success of it."

As a general rule, we do not advise a novice to attempt any wiring alterations to a mains set, because any mistakes in this class of receiver are liable to have more serious consequences than similar mistakes in a battery-driven set.

But the mere fitting of a dial-lamp is one of the easiest things possible, so it would be but the work of a few minutes to anyone accustomed to wiring. A dealer would charge very little for doing the job, or if you have a home-constructor acquaintance who would overlook it for you there is no reason why you should not do it for yourself.

You must, however, have a very clear idea of exactly what has to be done and—just as important—what must *not* be done, so do not attempt it without expert supervision.

This is the procedure: Disconnect the set from the mains by *removing the plug* from its wall-socket or lamp-fitting. (Do not rely on the switch to disconnect, because a fault or a momentary forgetfulness may result in an unexpected connection.)

Carefully remove the valves and decide where and how the little lamp-holder can be fixed in place, remembering, of course, that movement of the condenser vanes when the set is in action must be allowed for. If you are sure it is possible to fix the lamp-holder in a satisfactory position, decide how the wiring to it must be carried out.

The actual wire to use is of the twin-flex type, but it should preferably be of the shielded kind, which has a metallic braiding as its outer covering. (The internal wires are to be kept entirely insulated from this metal covering, which is generally best connected to the earth via the nearest screen, metal baseboard, chassis or other earthed surface.)

It is particularly necessary to use the shielded type of wire if the lead has to be more than, say, a couple of inches long; and even the shortest lead must be spaced well away from any of the wires to the tuning coils, condensers, etc., or you may get trouble from hum.

One end of this new flex lead must be carefully bared and its two enclosed wires taken to the respective terminals of the new lamp-holder. The other end, also very carefully bared, must have its two leads connected across the appropriate L.T. supply wires.

Often the best place to tap the L.T. supply is across the two "F" terminals of a valve holder, as you suggest, and the lamp used will then need to be of the same voltage as the valve which is inserted in that holder—probably 4 or 6 volts.

But sometimes it is preferable to tap across the transformer, and the marking on this is apt to be confusing.

Probably you would not find "4 volts" marked anywhere on it, but there might be three terminals marked "2—0—2." So it is imperative to have the job done by a qualified man or under the guidance of an expert, especially as the actual wiring must be flawless and must not interfere with the rather delicate surroundings in which it will find itself.

With expert guidance it is likely to prove a very easy and satisfactory alteration.

It is often a good plan to support the G.B. battery under the lid of the cabinet, as shown.

FOR BETTER RADIO

Neglect of the grid-bias battery is one of the most common causes of distortion. On no account should the battery be retained when its voltage is unreliable, or distortion and noises are likely to result.

* * *

Leads to the battery should be kept as short as possible, and the plugs must fit securely and firmly into the sockets. Always switch off the L.T. before altering bias voltages.

* * *

If there is doubt as to whether or not the G.B. battery is O.K., renew it, as, if it is *not* functioning properly, your H.T. battery will run down rapidly, and your output valve may lose its emission.

"I CANNOT GET ANYTHING AT ALL."

T. S. (Elmers End, Kent).—"When I bought it the set was supposed to be perfect, but I cannot get anything at all out of it.

"Except for B.B.C. too weak to hear words properly, it has got nothing, and as the chap has shut up shop I cannot take it back.

"Batteries are all in order, because they work on my mate's set. Valves are new. If you can't help I am over two pounds down the drain."

The cause of such a trouble can only be decided by a test, and you do not give us enough details for us to help you with suggestions for this. What the set really needs is an expert overhaul, and any good radio mechanic or service man would probably spot the fault right away when he got his testing instruments to work on it.

The valves ought to be tested, preferably by the makers, to ensure that they are still in good condition. Because they are new they are not necessarily up to standard, since there is always the possibility of damage having occurred after they left the makers.

Another very likely fault is a faulty switch, so the spring contacts of any wavechange or on-off control should be examined with care to ensure that its action is what it is supposed to be. Incidentally, dirty contacts are quite sufficient to account for loss of programmes, as any little scrap of insulating material, such as paper, will have just as bad an effect as a break in the wiring.

Another important point is the valve-holder wiring. Sometimes the internal connections fail or the valve-holder sockets fail to grip the valve pins firmly. (It may be possible to overcome this by opening the valve pins with a penknife.)

Perhaps the valve-holder terminal is not making contact with the valve-holder socket owing to a break underneath the component; this is the sort of fault that is very difficult to find until testing instruments are brought to bear on the set.

And you should be suspicious of any terminals that may have needed to be tightened. When this is done it sometimes happens that the bottom (fixing nut) is turned by the pliers, as well as the top one, which may break the wire internally, thus disconnecting the component from its own terminal.

So, you see, there are many places at which a simple fault may stop the whole set from working, and unless the owner knows a bit about the method of checking faulty apparatus he stands a poor chance of finding the fault by himself.

To anyone of experience with testing instruments the location of such a fault is a mere detail in the day's work, so we should certainly not regard the set as a bad investment until it has had a good overhaul.

THOSE MEDIUM-WAVE AMERICANS ARE STILL COMING OVER!

Our recent reference to the fall-off in trans-atlantic results was no sooner penned than we began to receive reports that indicated that better conditions were setting in again.

Several multi-valve-set owners have been surprised at the strength obtainable, but one particularly interesting report concerned a "P.W." *two*-valver.

It was from Mr. John A. Sabell, of 23, Leighton Road, Moseley, Birmingham, 13, who said, in a letter to the Editor:

"I built the 'Vol-Pen 2,' as directed in your issue of December 16th. I am more than delighted with the results.

"I am using a Marconiphone P.M. loud-speaker, and may I say that the quality is far better than any radiogram I have heard? I am supported here by all who have heard it.

"*This morning, at two a.m., I actually received, at loudspeaker strength, two medium-*

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

wave American stations. (One of these was giving an hour's variety directed by Fred Allen.)"

This is extremely good going, and it indicates that there is still a chance for the bagging of programmes direct from the other side of the Atlantic if one is lucky enough to choose a good period for listening, and provided, of course, that the set is well handled.

Incidentally, this set, "The Vol-Pen," has proved extremely popular, and a great many readers will be interested in a technical point raised by Mr. Sabell, which concerns the method of fitting an independent volume control to this two-valve receiver.

Quite an Easy Operation.

It is quite easy to do so in a manner that will permit the control to be effective upon radio and gramophone.

First, the existing lead which runs from the lower terminal of the radiogram switch to the pentode valve holder should be removed. The new wiring procedure is then as follows:

A ·5-megohm potentiometer-type volume control should be used, and can be mounted on the panel just above the radiogram switch. Its centre terminal—viz., that which connects to the slider—is first joined to the now vacant terminal on the pentode valve holder.

One of the new volume control's outer terminals must be joined to the vacant lower terminal of the radiogram switch; this places any desired proportion of the new resistance in circuit, according to the slider position.

The final connection is from the remaining (vacant) terminal of the new volume control to the metallised baseboard.

(If the makers of the pick-up should recommend some value for this which is different from the ·5 megohm (500,000 ohms) that is recommended for general use above it may be used exactly as described, the connections being the same whatever the resistance value chosen for the volume control.)

H.T. RUNS DOWN TOO QUICKLY.

J. G. (Market Drayton).—"I used to reckon an average of three months for the H.T. battery, but I have only run the new valve for fifteen weeks and have already had two new batteries. It can't go on like this.

"Would the change from a power to a super-power cause all that difference? (The other valves are the same as before.)

"I have always bought the same batteries from the same shop, so I think it must be the set that is at fault, especially as I always get the battery tested before bringing it away from the shop."

A change from power to super-power valves usually means that a larger H.T. battery will be needed. And if you are using one of the "double" type, and over-running it, a change to the triple-capacity type would be a real economy.

There are several ways by which you can ascertain what class of battery should be used. The easiest is to borrow a suitable milliammeter and insert it in the H.T. negative lead, when all voltages are correctly set.

This will give you the total number of H.T. milliamps. And you can then buy an H.T. battery which is intended to deliver a current of that amount.

Alternatively, the number of milliamps can be calculated from the valve-makers' literature.

A Double Check.

An additional advantage of making a milliammeter test is that it enables you to make sure that your trouble is not due, to some extent, to leakage owing to a faulty component in the set.

To test for this, all you have to do is to have the milliammeter connected, as explained, in the H.T. negative lead; and after having noted exactly how much current the set takes when "On," turn the L.T. switch to the "Off" position.

When this is done the milliammeter should read 0. But if there is a fault in the set you may find that the needle does not fall right back to zero, but still shows a slight current flow, although the set is off.

Such a fault, generally traceable to a broken-down condenser or faulty insulation of one of the H.T. carrying leads, is quite enough to account for the excessively quick running down of the batteries.

And with the milliammeter connected as above you can soon find in which part of the set the fault lies, because the disconnection of the various H.T.+ leads in turn will enable you to get the unwanted reading with only the H.T.— and one H.T.+ lead in circuit, and with some of the valves pulled out.

But unless you have had some experience in fault-finding and wiring, etc., we advise you to get someone of experience to do the job for you, or you may make an expensive slip and connect up something wrongly.

STATION IDENTIFICATION

VIENNA

The Viennese programmes have always been popular in this country, and now that the station works on high power (120 kw.) they are easily received.

* * *

The wavelength is 506·8 metres, and the dial reading just below Stuttgart's, near the top of the dial. Vienna is some 767 miles from London, but has been coming over very strongly of late.

* * *

The announcer closes down with the words "Gute Nacht" (Good-night) and pronounces the station's name as "Radio Veen."

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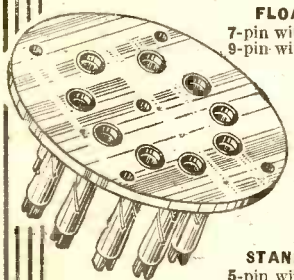

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HELPING THE ELECTRON

(*Continued from page* 109.)

Fig. 2 shows the circuit used for an oscillator. The coils are only one-eighth of an inch in diameter! The shortest wavelength at which oscillation has been obtained is 30 centimetres, using only one turn.

But the valves are more useful at two or three times this wavelength, and tiny receivers have been built which show quite a useful H.F. amplification as low as 75 centimetres. Even a multi-valve all-screened set produces a barely perceptible bulge in one's pocket. And the size of the aerial is definitely of the drawing-room-table variety.

It is obvious that unfortunately this miniature valve idea can't be applied very usefully to transmitters unless one is content with a correspondingly miniature power and range. The electron-path oscillators still look the best at that end. But the midget valves may well find very extensive use at the receiving end.

THE LISTENER'S NOTEBOOK

(*Continued from page* 120.)

Clearly the two are not the same; neither is it immaterial which of the two is used in broadcasting. Broadcasting demands one style and one style only.

Lady Rhondda reached a very high standard of broadcast eloquence. In fact, her talk left on my mind the most lasting impression of the lot. Lloyd George left the impression that he is still the politician.

* * *

That Wednesday evening feature, "Some British Institutions," offered rather a mixed bag. Some of the talks I found quite interesting. Others were a bit stodgy. The talks on the City of London appealed to me most.

* * *

"Industrial Britain," taken irregularly, wasn't altogether unpalatable. These questions have been so long in the air now that they haven't the freshness of a new topic. Yet the manner of the talks was stimulating.

The Short Story.

I notice a reference to a "revival of interest" in the short story. On whose part, if not the B.B.C.'s? The public has always been interested in the short story. Its absence from broadcast programmes has always perplexed me. I've always thought this form of entertainment such an obvious one, and with the hundreds of short stories all there for the asking. Ye gods! It doth amaze me!

However, there is a revival of interest, and a list of well-known writers has already been drawn up. I wouldn't discourage the idea for worlds, but it seems a bit odd that this revival of interest should coincide with the return of the lighter evenings.

* * *

It is still possible for Sunday evening fare to be bad. I say emphatically that chamber music shouldn't be allowed to monopolise 105 minutes of programme space at a time. It just upsets one for the rest of the night.

The Lyra Quartet would have left pleasanter memories behind them recently if they had packed up after their third item—Beethoven's Serenade. But they went on to do two more things which couldn't have been written for entertainment purposes.

Performing and listening to chamber music do not afford identical pleasures.

* * *

Those choral recitals of Church music, broadcast monthly, will probably run for a year without opposition. To those who are fond of sacred music—and their numbers can hardly be over estimated—these "half-hours of quiet loveliness," to quote Sir Walford Davies, are a source of real pleasure.

The Wireless Singers have now an established reputation, and need fear no frown or court any favour. With "The Pilgrim's Way," two Sundays a month have at least one item to commend them.

* * *

If I were to say that Van Phillips and his All-Star Orchestra were the very best thing we have ever listened to in the way of popular music would anyone contradict it? I don't think so. I cannot recall anything better since broadcasting began. **C. B.**

MAKE A NOTE OF THESE IDEAS

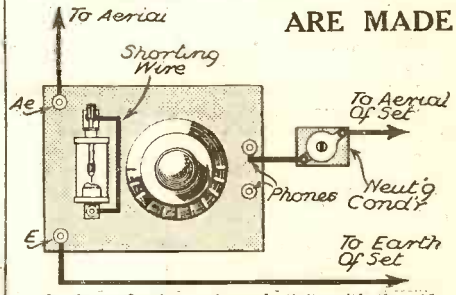
Two tips which are worth while remembering.

IMPROVING SELECTIVITY.

A TUNED circuit can often be added in front of a set which does not give very sharp tuning, to improve selectivity. Where an old crystal set happens to be on hand, this can usually be employed quite effectively, providing the circuit arrangement of the crystal set is fairly straightforward.

Connect the aerial to the A terminal of the crystal set, and join the E terminal of the crystal set to the E terminal on the main receiver. Next, connect the aerial

HOW THE CONNECTIONS ARE MADE



A scheme for improving selectivity with the aid of a crystal set.

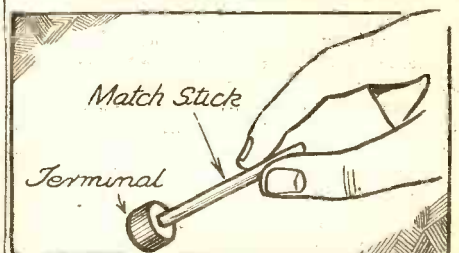
terminal of the main set through a "neut" type condenser to one of the phone terminals on the crystal set.

The correct phone terminal can best be found by trial. Finally, short the crystal detector by a small piece of bare wire.

FIXING TERMINALS.

SCREWING terminals in awkward positions is by no means an easy task, and even the most experienced constructor encounters difficulty in fixing a nut under such circumstances.

FOR EASY STARTING



Illustrating a good method of dealing with awkwardly situated terminals.

A good remedy to overcome this is by the use of a match stick, as shown in the diagram. It will be found that the dead end of a match is of a size sufficient to enable the constructor to gain a firm hold, and in this way the terminal can be easily manipulated into position.

THE NEW "EVERYBODY'S THREE"

(*Continued from page 116.*)

by the coils, and using transformer coupling between the screen-grid and detector valves.

A single three-point wavechange switch enables both bands of wavelength to be covered with the greatest of ease, and the screening of the coils obviates the need for any inter-valve shielding in the set.

Separate tuning control is provided for each coil. This is an important feature, not only where cheapness is concerned, but also from the point of view of accuracy of tuning. Although the coils are matched by the makers, and can therefore be used in gang-tuned circuits, everyone will agree that to get the very last iota of selectivity in a circuit of this simple description it is essential to use separate tuning controls.

The Part Played by Reaction.

The aerial loading on the one hand and variations in tuning caused by reaction alterations in the detector circuit, though small, would be sufficient just to take the edge off the sharpness of the set if a ganged condenser were used.

It must be remembered that reaction can play a very great part in the degree of selectivity achieved by a set, and that, though the coils of the New "Everybody's Three" are particularly sharp in tuning, the addition of reaction increases even this sharpness, so that the capabilities of the set to concentrate on one wavelength to the exclusion of others, even though they are occupied by powerful stations, are immense.

When great selectivity is desired one has to look out for quality, lest it should suffer, so that the choice of a good coupling system between the detector and the output stages is one of great importance. In this receiver we have again considered price as well as technical excellence, with the result that we decided to use a Bulgin "Senator" transformer, employed in a shunt-fed circuit between detector and output valves.

The transformer has a surprisingly high primary inductance when used in this manner, and it will look after the full range of musical frequencies in a very satisfying manner.

Simple to Construct.

We achieved an inexpensive and selective receiver by the means described above; it only remained to make the design simple to construct. That simplicity is obtained (1) by using a large baseboard, so that there is plenty of room for everything, and (2) employing a metallised baseboard, so that a number of the earth-return wires may be omitted, the metal covering of the wood taking their place. This greatly simplifies the wiring.

The diagram of the layout and wiring is self-explanatory. It shows not only the layout, but also the back-of-panel drilling dimensions, while the number of places marked "M.B." shows the degree of wiring saved by using the baseboard surface as a metal link between various parts of the set.

The operation of the New "Everybody's Three" is perfectly novel. There are no preliminary settings to do; it is merely a matter of connecting up the batteries, aerial and earth and loudspeaker (an Amplion in the case of our tests) and switching on.

The batteries required are 120-volt H.T. and a grid bias to suit the output valve—probably you will use a "small" valve here, like the L.P.2 or P.220, in which case a 4½-volt battery will be ample. If a "larger" valve is employed the grid-bias battery should go up to 9 volts. The L.T. is, of course, 2 volts.

Place H.T.+1 into 75–80 volts on the H.T. battery and H.T.+2 in the full 120 volts (a mains unit giving these voltages can be used, if desired). Pull out the wavechange switch for medium waves and push it in for long waves.

The tuning will be found to be sharp, so care must be taken that the tuning controls are moved slowly and in step, otherwise it will be easy to overrun stations without hearing them. You will require a little practice on the set before you will be able to get the full use out of it, because, as we said before, reaction will play a considerable part in aiding station selection on a set with the selective powers of the New "Everybody's Three."

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This week's POPULAR GARDENING (now on sale—2d.) contains a splendid FREE GIFT which will help you to have a brilliant display of flowers in the Summer—a packet of Scarlet Flax seeds, one of the most graceful and beautiful of hardy annuals.

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PLEASE be sure to mention "POPULAR WIRELESS" when communicating with Advertisers. THANKS!

THE LINK BETWEEN

(*Continued from page* 110.)

A descriptive leaflet of this comprehensive circuit tester is available to "P.W." readers through the medium of our postcard literature service. **(No. 82)**

H.M.V.'s Latest.

Even radio folk have to eat! And for that very reason I feel that I may be forgiven for breaking away from radio for a sentence or two in order to tell you something of H.M.V.'s latest activities.

Their very latest product is a streamline refrigerator, and judging from the photographs I have seen it worthily upholds the company's reputation for high quality workmanship. It's certainly an interesting departure, but what I am particularly interested to know is whether it is of the interference-free variety! You see, my next door neighbour has a refrigerator, and unlike my own, I can't get at it. Result: noise, noise, and then more noise.

However, I have no doubt that H.M.V. have given due consideration in the design of their new refrigerator to the question of interference with radio reception, and as soon as I have obtained confirmation on the point, I intend to slip one of the descriptive leaflets through my neighbour's letter-box. There's hope even now that one of these days I shall be able to enjoy a radio programme free from both cold storage and hot air!

OUR POSTCARD SERVICE

Application for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way — just quote the number or numbers.

TELEVISION— A PROBLEM OF PROGRESS

(*Continued from page* 103.)

any kind of new transmission, whatever the change in scanning lines or picture frequency.

It will be *properly* in step, too, with no makeshift of any kind, so that we shall be able to take the fullest advantage of the picture. This, by the way, does not apply to all the suggested methods which one sees for the modification of drum and disc apparatus.

As to the exact methods to be adopted in resetting the time-base circuits, I cannot give practical instructions at this point, for the obvious reason that nothing is yet known as to the probable nature of the hypothetical new transmission, but no doubt the correct procedure will be described in due course for the benefit of users of the "P.W." cathode-ray receiver.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Signal Strength.

IS the strength of the incoming signals really important in relation to the volume of the output from the set? Many people seem to have the idea that the incoming signal strength on the aerial, for instance, is "neither here nor there," since anything can be made up by amplification.

This, however, is really a mistaken notion. Don't forget that although there is an enormous multiplication of the signal energy taking place in the set, nevertheless that signal energy is the first factor in the multiplication series, and that, if any one factor is doubled, the whole result is doubled. This, in passing, assumes that the amplification remains the same for different signal inputs and volume outputs. The amplification may not remain quite the same, but it is near enough for us to say that any increase in the signal input has a *corresponding* effect in increasing the volume output.

If you think about it for a moment, this must be so, otherwise how would you get the variations of loudness in a band, a singer's voice and so on? It is simply by variations in the strength of the input.

Aerial and Pick-up Efficiency.

Now, all this sounds very obvious, but yet it is surprising how many people do not trouble to use an efficient aerial (or pick-up), because they regard the initial energy as of no importance. Remember that the initial energy, whether from aerial or pick-up, is all you have to work on, and if you have *twice* as much initial energy, so you have *twice* as much material to work on.

Therefore it *is* worth while to use an efficient aerial and a sensitive pick-up, and not to rely too much on amplification. There is far less likelihood of distortion if you start with a reasonable amount of signal energy than if you start with a very small signal energy and have to use enormous amplification.

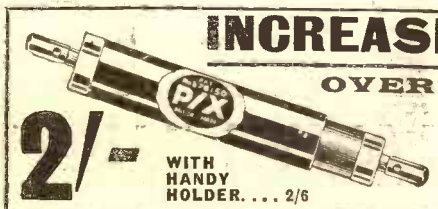
Constructors' Sets.

I don't know what is the proportion of people who construct their own sets as compared with those who buy commercial sets. There are lots of people who construct their own who could, of course, well afford to buy a commercial set. And the reason so commonly given—namely, that they enjoy the making of them—is not the only reason.

Another important consideration is that the constructor can so design his set that

(*Continued on next page.*)

INCREASE THE SELECTIVITY OF YOUR SET!



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PIX

TECHNICAL NOTES

(Continued from previous page.)

he can adapt and modify it from time to time as new components or ideas come along.

In this way he is able to keep the set up to date all along the line, as it were, and is in no fear of his set becoming obsolete. Incidentally, I have often noticed that people put off buying a wireless set because they are afraid that—since radio progresses so rapidly—the set will be out of date before they've had time to turn round.

Improvements in Set Design.

This is putting too fine a point on things, because wireless sets are so good to-day that they cannot improve by leaps and bounds—I mean, so far as the *results* are concerned. It is true that improvements are constantly being made, but they are in the *means* by which the results are obtained rather than in the results themselves.

A New Use for Sound Waves.

An interesting bit of news from America says that sound waves are being used for sterilisation of milk and beer. I seem to remember something about this some time ago, very high-sound frequencies being used. It appears that these frequencies kill bacteria very quickly, and without affecting the taste of the liquid, which is one of the drawbacks to heating methods. The new method is called—rather characteristically, I think—"shock pasteurisation." A good American sound about that, don't you think?

Radio Receiver Requirements.

I was talking to a man a day or two ago about the choice of radio sets, and he made a remark which struck me as very true, although I had not really thought about it in quite the same light before. He said that he thought most people—or, at any rate, *many* people—overestimated their requirements in the matter of radio, just as in other things.

By this he meant, as he went on to explain, that they *must* have a multi-valve set (perhaps even a superhet) able to get everything under the sun, whereas in actual practice, having got such a set, they would tune to a couple of B.B.C. stations (generally the National and Regional).

The same sort of thing applies to motor-cars. A man feels quite at a loss if his car will only do 55 or 60 miles per hour when the other fellow's is capable of 80, whereas in point of fact probably neither of them ever goes more than 45–50, anyhow.

Simplicity of Operation.

I think there is a good deal of truth in this, and it means that people probably go to a great deal more outlay than is necessary. After all, if you only want the local stations a 2- or 3-valve set will be ample, which will be much cheaper in cost and upkeep, not to mention simplicity of operation and possibly quality of reproduction. So the point is worth bearing in mind when considering the purchase of a set for yourself or when advising a friend on his probable needs.

Of course, there are cases where a larger set is absolutely necessary. For example, if you are "under the shadow" of the local station and want to reach out for foreigners, then you want a really selective set, and a superhet may be practically a necessity.

Again, if conditions are not so drastic, but you are content with half a dozen to a dozen stations, you will probably get all you want with a 3-valve receiver of the conventional screen-grid, detector and pentode variety. A good deal, in such a case, naturally depends upon the efficiency of the aerial system.

The Importance of Selectivity.

As regards getting foreign stations, selectivity is, of course, a very important factor, and this again depends a good deal upon local conditions, such as the proximity of the local station. For good selectivity it is an advantage to use a set having at least three tuned circuits. You may have one H.F. with band-pass input and a single tuned intervalve coupling, or two H.F. stages with three single-tuned circuits. As you will gather, the first method is applicable to a set such as a 3-valve set using one H.F. stage, whilst the second method applies to a set with 2 H.F. stages, such as a 4-valve set with detector and 1 L.F. The three circuits should, of course, be ganged.

The Benefit of Iron-Core Coils.

Iron-core coils will make for increased selectivity, so that their use with the above-mentioned circuit arrangements should enable you to get pretty well all the selectivity you require. On the other hand, the characteristics of the iron-core coils necessitate extra care in the ganging arrangements and in the wiring. It is hardly necessary to mention that "unbalanced" wiring may completely preclude the obtaining of accurate ganging.

I have spoken of the selectivity to be obtained with three tuned circuits, but for special cases you may have to go to four tuned circuits or a superhet.

(Continued on next page.)

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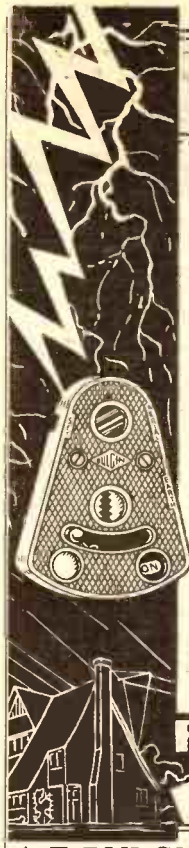

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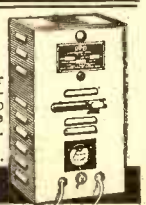

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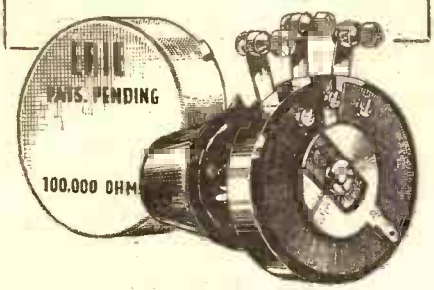

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TECHNICAL NOTES

(Continued from previous page.)

Local Interference.

Here is something about local interference, which is still one of the important drawbacks of modern sensitive sets, especially mains sets. The clicking, sizzling, pulsating and other noises which are picked up often mar reception very seriously.

This is especially the case in blocks of flats or such-like buildings where there is certain to be a variety of electrical machines of different kinds (including electric lifts—amongst the worst offenders), and where the electric lights are being continually switched on or off somewhere or other in the building.

Employing Filters.

As I mentioned before, there are now all sorts of devices and dodges for cutting out this type of interference: generally such devices take the form of what might be called "filters," consisting of different arrangements of chokes and condensers.

It is more difficult to cure the trouble if the device is used in proximity to the *set*, although, of course, this is the most convenient and indeed the obvious place for it. The simplest way to attack the problem is to place a filter or absorbing device in immediate association with the offending machine—say an electric motor or whatever it may be.

How Clicks Come In.

As regards mains sets, it is always rather tricky to decide whether the interference—especially the "clicks" when lights are switched on and off—come in on the aerial or on the mains leads. I have made a large number of tests on this point, and have come to the conclusion that, in the majority of cases, it comes in on the aerial. This makes it harder, because, although we can shield the leads and other parts of the set, clearly we cannot shield the aerial, otherwise we should receive no signals.

Shielding the Aerial.

It has been found, however, that this kind of interference is generally very "local"—that is to say, its influence does not spread very far. This gives us a clue to the aerial-shielding question, for it means that we can shield the part of the aerial nearest to the source of disturbance (the lead-in, as a rule) whilst leaving the aerial itself unshielded.

An American radio engineer, Mr. H. J. Adler, has done a lot of work on this, and has found that shielding the lead-in (with proper circuit arrangements) can be made to give enormous improvements in the results. For the shielded lead-in a pair of twisted wires is used; one of these is connected to the aerial, the other being a free end.

Using a Special Transformer.

The lower ends of the two wires are connected, each through a condenser, to the primary of a special transformer, a tapping of this primary (not necessarily a centre tapping) going to earth. A shield of tinfoil is introduced between the primary and secondary, the terminals of the secondary going to the aerial and earth terminals of the set.

As a general idea of values, the two halves of the primary may be 100 microhenries each, whilst the secondary may be 3,000 microhenries. Of the two condensers the one in the shielding lead should be about 0·1 mfd. fixed, whilst that in the aerial lead should be variable, maximum value about 0·1 mfd. The idea is that the "noises" on the two wires cancel out in the transformer, leaving the signals tuneable.

The Results That Are Claimed.

According to tests made with such a shielded lead-in (and, of course, a carefully shielded receiver, for it is no use shielding the one without the other), it is claimed that no interference was caused when a one-inch sparking coil was worked a few inches away. Vacuum cleaners, electric motors and lifts caused absolutely no interference.

This sounds very good, and I thought at any rate it would be interesting to those of you who are very much troubled with "man-made static," as our American friends call it.

The Question of Maintenance Costs.

My remarks on the question of battery costs have brought me many letters from readers, and I have been struck by the number who methodically keep records of such things. Of course, it is a very good plan to keep a check, and the information thereby obtained is most useful.

One very businesslike letter (after some very kind remarks about Technical Notes, which I much appreciate) goes on to give precise details for the four years 1930–1933. The writer says:

"Mine is a 2-valve set, 2 volt (Det. and S. Power). Average voltage 120. Average daily use 8 hours. All wet accumulators of 5,000 m.a.-hour capacity. Cost of charging H.T. and L.T. for last four years: 1930, £1 16s., average 3s. per month; 1931, £2 2s. 6d., average 3s. 6½d. per month; 1932, £1 18s., average 3s. 2d. per month; 1933, 18s., average 1s. 6d. per month. In September, 1933, I added a Westecter coupled to anode of power valve. The value of this is evident in the reduced cost of charging."

I think my readers will regard the foregoing extract as very useful. The reduction in the last figure is most striking, and one wonders whether it can *all* be due to the cause suggested by the author.

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by
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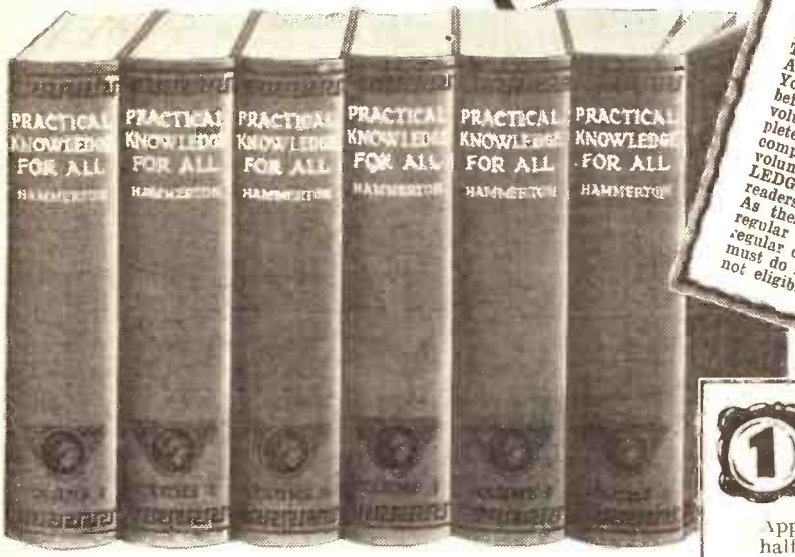
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Popular Wireless

No. 620. Vol. XXV. April 21st, 1934.

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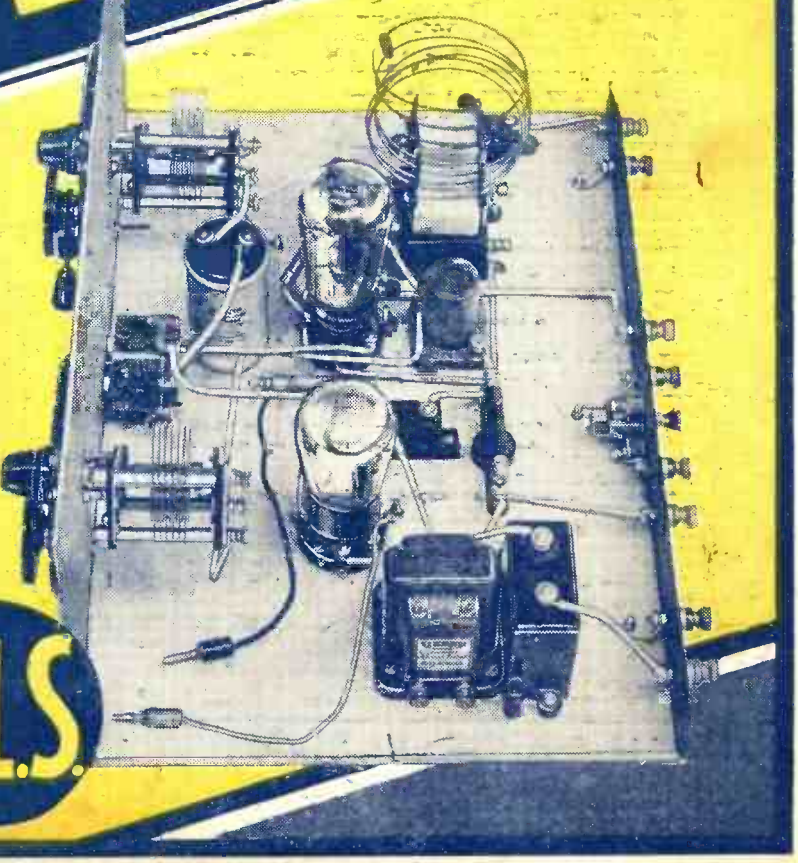

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MY AERIAL
ABOUT BOD
CHEAP CHARGING
FOURPENCE CHANGE

RADIO NOTES & NEWS

RIGHT ON TOP
WHITSTABLE NATIVES
BUDDING COWARD
KIRK MICE

Champion Procrastinator.

CONSIDERED as a person who from time to time takes upon himself the task of acting as guide, philosopher and counsellor to "P.W."-ites, I am painfully aware that my aerial has turned me into a hollow sepulchre and a whited mockery. I am, in truth, the World's Champion Procrastinator, as my correspondents well know.

Further, I confess that work on an aerial—in a prickly sort of tree especially—or even the thought of it, tends to send me out into the highways and byways in search of unemployed sailors, steeplejacks, cat-burglars and the like.

The Growth of a Tree—and Ambition.

SOME years ago my aerial came along housewards from a six-foot pole lashed to a charming young copper beech. Then began those worthy aspirations of the beech which have turned me into the miserable creature that I am, for the tree, stimulated by the presence of the pole, made up its mind to "go all pole"; hence in one year it had shot forth a battery of pole-like branches which eventually reached the wire.

I have lopped and lopped, but the tree thrives on the process. I have de-sagged the wire almost beyond the safety point, but the tree is overhauling me. "This Easter," I thought, "there must be a new pole, soaring beyond the dreams of a beech which thinks it is a Douglas fir." But the weather——!

Radio to Channel Islands.

AT Compass, Dartmouth, there has been established an experimental wireless station for communication with the Channel Islands. It works on five metres. If the tests are satisfactory, the Post Office will make the station and service permanent, thus providing a route alternative to the existing cable service from Compass.

Literary Cross-References.

THE lighthouse steamer Hesperus of Oban is to be fitted with wireless telephone apparatus. Hereafter this news item becomes literary. Longfellow creeps in with the name of "Hesperus." If *his* Hesperus had had a direction finder his poem would not have ended as it did. The wireless is for communicating with the lighthouses on the west of Scotland, and these same lighthouses already speak daily with the shore station at Erraid, Mull, one of them being Skerryvore.

POPULAR WIRELESS—ALWAYS FIRST

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THE FIRST news of every new development in radio technique, every new event in B.B.C. programmes, all items of interest to listener and constructor will be found in POPULAR WIRELESS.

And last month POPULAR WIRELESS gave you the very first, exclusive news about

"BIFOCAL TUNING"

together with a "Bifocal" receiver designed by leading Radio firms in Great Britain.

WHERE "P.W." LEADS —OTHERS FOLLOW

Now, Erraid was the place where David Balfour, in "Kidnapped," was wrecked on the brig Covenant. Again, Skerryvore lent its name to R. L. Stevenson's house at Bournemouth, given to him by his father, the son of the builder of the lighthouse.

How They Lined Up.

AT the end of 1933 the number of licensed receivers in Europe, excluding Russia, was 17,882,465, and the estimated number of listeners (including Russia) was 84 millions. Although Denmark still had the highest percentage (15 per cent) of licensees to population, the highest number of licensees per country was found in Great Britain, which had 5,973,759. Germany came second with about 5,070,000, and France third with 1,367,715. Plenty of scope before saturation need be spoken of.

A Radio Miracle?

IT is reported from Moscow via Berlin that a man who had died from heart failure was restored to life by a Professor Smirnow, who subjected the "deceased's" heart to the influence of ultra-short waves. I am always anxious to claim as much glory for radio as seems consistent with the facts, but I do not feel comfortable about this instance. In the first place, the well-known heart massage has often done similar things; and, secondly, we are not told for how long the man lived afterwards. Then, again, the doctors *and* the professor certified death before the operation was performed, and I am simple enough to believe that if a person is dead he is dead. Are we to have a new definition of the word?

Up-to-date Technical Details.

FOR those who like to keep a record of the characteristics of radio stations I give the following details of the Rumanian station which is to be erected at Bod:

Aerial energy, 150 kilowatts; series modulation, up to 95 per cent; aerial ice-melting plant and water-cooled valves. Can operate on 1,030 to 2,140 metres, and power can easily be doubled. Transmitter has two-stage H.F. amplifier, series-modulated by a three-stage acoustic frequency modulator. Modulated output is

(*Continued on next page.*)

MAKING AMERICA KEEN ON RADIO!

amplified by a single-power amplifier with six water-cooled valves, C.A.T. 12A type.

Transmitted frequency is stabilised by a valve drive, followed by a harmonic selector and H.F. amplifier and isolator stages.

Accumulator Athletics.

EXPERIMENTAL rural broadcasting is to be undertaken in the North-West Frontier Province of India over a period of a year. The problem of battery charging will be tackled by connecting a motor-car generator to the back wheel of a bicycle, which will be pedalled by native labour.

It has been suggested that schoolboys could put in a few minutes a-wheel every morning for gymnastic exercise. Why not attach a gadget to measure the mileage and hold bicycle races? The battery would then be charged for nothing.

From Plough to Harvest.

NATURE note about Foster Richardson, the singer: As a boy he led one of the plough teams on his father's farm and sang with the ploughman at his work. Eventually won a scholarship at the Royal Academy of Music, and later had a hard struggle before getting his first engagement. Fee—ten shillings. Gave the bus conductor the half-sovereign in mistake for a sixpenny piece; hence net revenue for his first job was the fourpence change!

Another "World's Highest."

THE latest entry for the altitude stakes is the station at Summitt, California, which is said to be the world's highest airways radio station. It is situated, or perched, 7,200 feet up in the Sierra Nevada, and is occupied by six world's-highest airline radio men who service the transcontinental air liners.

This station is literally "nevada" in winter, and supplies have to be conveyed to it per snowshoe express. As the winds there are boisterous the world's highest, etc., maintains its proud and chilly position only by virtue of the fact that it is held by steel cables.

Eckersley Again Expounds.

TO be allowed to read just one paper before the Institution of Electrical Engineers is an honour to which all radio and electrical engineers aspire.

But it seems to be a habit with P. P. Eckersley, our Chief Radio Consultant! The very day I write these words he is to address a Wireless Section meeting on the subject of "Audio-Frequency Wire Broadcasting."

If the Proceedings of the Institution (which permanently record the more important papers in full) are, as I believe, an index to contemporary leadership in radio and electrical erudition and invention, then P. P. E. must surely be included in the world's first half-dozen great radio engineers of our times.

More Than a Kid Mimic.

THERE is a great deal more "to" many of these variety artistes who delight and amuse us than you might think.

Harry Hemsley is a scenic artist as well as the most wonderful child imitator in the world. He was also once a lithographer. Whilst studying art in Berlin he discovered that through his sketches of children he could impersonate their voices and mannerisms. Hence—Harry Hemsley!

"Agony" Note.

IF this should meet the kindly eye of the Roche reader who recently wrote to me, he will learn that Mr. B. Gordon, 4, Hartington Place, Edinburgh, having reached the advanced age of twelve, has taken up short-wave work and finds the matter to be slightly more complicated than Pons Asinorum.

He earnestly desires details of the wonderful one-valver which I mentioned in "P.W.," March 24th. If J. T. is agreeable, perhaps he will make direct contact with this young striver.

Not What He Wanted.

IN technical circles there is much talk of a new magnet steel alloy which is to do wonders for loudspeakers. This alloy, it is said, was discovered by a Japanese scientist whilst he was searching for a substance which cannot be magnetised, the poor, unfortunate child of Nippon!

I have never thought much of the—hem!—magnetisability of Dutch cheese; its countenance is so unpromising. But a designer of stereoscopic, focusing vernier, ganged short circuits, here at my elbow, backs Mac West to accomplish the miracle.

Now Then, Natives!

WILL natives of Whitstable and dwellers in the nearer parts round about rally to the call of Mr. P. A. Sale, 124, Clare Road, Tankerton, Whitstable, who proposes to start a wireless club for you if you are numerous enough?

All interested should write to him at the address given, bearing in mind that Mr. Sale's notion of a club is inseparable from short waves and television. I shall expect to report progress shortly.

Trying to Gild the Lily.

I UNDERSTAND that the Institute of Radio Service Men, Chicago, are holding a "100-per-cent Radio Week." That is excellent and just as it should be—even the 100 per cent.

But the avowed object of this week of hustle is to make America "radio minded," and I confess that this faintly amuses me. For if America be not radio minded already, then my name is Henry Ford and I make fifty-seven varieties!

Trying to make Americans keen on radio strikes me as much the same as trying to get a German to sit up and bite a sausage.

"The Play's the Thing."

I AM beginning to feel pleasantly excited about the result of our Radio Play Competition: first, because I am anxious to know whether it will bring out some hitherto mute, inglorious Galsworthy, Coward or Shaw; second, because I want to hear many more good radio plays.

For the man or woman who can combine the required technique with the stuff which runs for six months or more, Petty Eldorado waits.

"Mice and (Scotch) Men."

THE "Broadcaster" tells the story of how the performance of a gramophone amplifier in a Glasgow restaurant went off colour—if I may use that word in reference to an acoustic matter. Investigation of the mains transformer showed that a syndicate of nine mice were camped therein and had eaten a large portion of the insulating material.

Awful reflection! If mice are reduced to such fare in a Scottish *restaurant*, what a thin time the *kirk* mice must have!

A Prominent Radio Figure Passes.

WITH regret I announce the death, at the age of sixty-nine, of Major-General G. O. Squier, whose name and work were familiar to the radio men of pre-war days.

General Squier, who was technical adviser on electrical communications to the U.S.A. Government, came into prominence because of his work in connection with "wired wireless," which he conceived and developed, his first experiments being made at Washington.

ARIEL.

ON THE AIR NEXT WEEK:

Frank Cantell (*Midland Region, April 24th.*)

Golf and motoring are the principal hobbies of Frank Richard Cantell, director of the Midland Studio Orchestra. But he has never had much time for indulging these hobbies since he was born in Birmingham thirty-three years ago. Musical director of several Midland cinemas, principal viola of the City of Birmingham Orchestra and leader of the old Birmingham Studio Orchestra were the stepping stones to his present position. He is also Musical Adviser to the Midland Region, which position he took over from Joe Lewis when the latter went to London.

DESTROYING MAN-MADE STATIC

There is no need to put up with those cracklings, buzzes, clicks, etc., that are produced by electrical machinery and mains, for there is a cure for practically every type of this trouble. This is the first of a specially commissioned series of articles, each complete in itself, which will form an indispensable treatise on the overcoming of man-made static.

By BERNARD BARNARD.

"MAN-MADE static," or electrical interference with broadcast reception, is probably the most serious obstacle to our progress towards perfect wireless enjoyment to-day.

There are, of course, other imperfections in plenty, but I doubt whether any of them affect listeners so personally and directly as the reception of the hideous crackling and buzzings that are the audible indications of nearby radiating machinery.

Considerably over 10,000 listeners complain annually to either the B.B.C. or the Post Office that they are sufferers from interference, and this suggests that probably nearly a million receivers are affected.

A Special Investigation.

A great deal has been spoken and written with regard to introducing legislation of some kind to combat the trouble. At the time of writing there is a special committee sitting which has been set up by the Institution of Electrical Engineers to consider the scope and form of such legislation; unfortunately, the published purpose of the committee also contains the rather disheartening proviso—"if any."

Legislation has been attempted in other countries with varying degrees of success, and, in some cases, severe penalties are inflicted on the owners of radiating electrical plant. I leave the reader to decide for himself whether such a Bill would obtain support in Britain, but I do definitely suggest that owners of electrical machinery should be legally responsible for keeping their plant in reasonable condition and repair.

This alone would cut down interference by an enormous amount, for where sources of interference are investigated it is nearly always found that it is the *condition* and not the *type* of machinery in use that gives rise to radiation.

The Official "Complaint" Form.

It would be unfair to offer any criticism of the committee's work at such a stage as this, and I certainly wish them every success, but I feel very strongly that really effective legislation in this country is foredoomed.

The harassed listener must therefore look elsewhere for relief from his affliction; he need not go far afield, for most of his troubles, like charity, begin at home.

In order to prove this it is only necessary to consider the experience of the majority of the 10,000 people who go to the trouble of complaining to the Post Office.

The interference sufferer obtains a special "Complaint Form" from his nearest post office, in which he is asked to give certain details of the interference which he experiences.

Quite Easy to Complete.

This form is very simple to fill up, but the information asked for is sufficient to enable the P.O. engineers to decide whether the interference complained of is genuine, and, having regard to such matters as locality and quantity of complaints received, whether the case warrants the expense involved in special investigation.

If the investigation takes place, it is usually found that simple mains-filter apparatus or aerial modifications produce the desired relief. In very fortunate cases the owner of the radiating plant is located and is persuaded, by tactful efforts of the P.O. engineers, to have the necessary smoothing gear fitted to his machinery, thereby curing interference for perhaps hundreds of listeners by one simple piece of work.

These latter cases may be considered to be the real province of the Post Office as far as interference is concerned. Obviously they are out to effect a cure that will be of benefit to the greatest number of listeners, and amateurs are strongly advised to refrain from attempting to approach machinery owners on their own account. More harm than good usually attends such efforts, and the outcome may be to make the owner unsympathetic towards listeners' comfort.

STOPPING INTERFERENCE

Even the electrically-driven drill used by the dentist when stopping teeth can cause interference with radio sets. Here you see an engineer checking up the effectiveness of a silencing circuit.

Individual Investigation Required.

The reader may well ask at this point: "Why is it, then, if interference can so easily be reduced by the application of simple filter apparatus or by installation modifications at the receiving end, that one single device is not available by means of which I can put an end to my trouble?"

The answer to this is that each interference case has to receive individual attention and investigation, for, as we shall see later on, there are so many different ways by which the interfering energy may enter the receiver circuit.

It may enter through the electric-supply main, or it may be picked up by the aerial; it may be pure H.F. radiation, or it may be introduced by L.F. induction; it may be a simple interfering signal on its own, or it may modulate received carrier-waves.

Usually a Mixture of Causes.

Whatever the case, the treatment required is different, and, as in practice it is often found that a mixture of all these possibilities is causing the trouble, the reader will readily appreciate that one well-defined remedy for so complicated a fault is quite out of the question.

As a result of the foregoing I hope that the non-technical reader will take heart and obtain the necessary interference complaint form from a post office, fill it in intelligently and send it to the indicated authority.

The technical man and the enthusiastic amateur will, I also hope, equally take heart and prepare to subject his entire installation to a thorough investigation under guidance I shall give in future articles on this subject.

Theory and Practice Disagree?

This guidance, by the way, is the result of three years of intense practical anti-interference work which I undertook on behalf of one of the largest radio manufacturers in this country, and the reader need not therefore fear that he is to be subjected to a lot of irrelevant theory. Indeed, he will find that in very many cases theory in the matter of interference is not upheld in practice.

PUSH—PULL SIMPLY EXPLAINED

A PAGE FOR BEGINNERS

Describing, in easy-to-understand language, the principles and terms used in everyday radio practice.

By G. V. DOWDING, Associate I.E.E.

POTENTIAL DIFFERENCE.

The difference in voltage between two points. Current tends to flow from the point of higher potential to the point of lower potential.

The potential difference existing between the terminals of a generator or a battery may not be equal to the voltage developed by that device, because when current flows a certain proportion of the voltage will be lost in overcoming the internal resistance of the apparatus generating the current.

POTENTIAL DIVIDER.

A component whose purpose is to obtain a variation of voltage. It comprises a resistance with one or more tappings.

Connection to one of the tappings and one end of the device provides a potential difference equal to the ratio of the resistances.

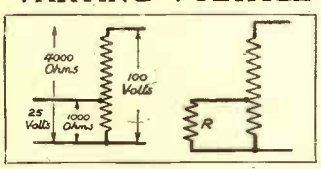
For example, suppose the total resistance of the device is four thousand ohms and the potential difference across it is 100 volts.

If the tap is taken across one thousand ohms, then that represents a quarter of the whole resistance, and the voltage will be a quarter of the one hundred, i.e. 25 volts (see diagram).

For the purpose of this example it is assumed that current is not drawn from the circuit. As is often the case it is, and the calculation needs revision.

The drawing of current means that there will be a complete circuit joined across that part of the potential divider to which we are referring. Let us show this as another resistance symbol (R in diagram). Now, it will be clear that that part of the potential divider across which the circuit is constituted has its resistance lowered (in effect)

VARYING VOLTAGE



The diagram on the left shows how the voltage is tapped in direct proportion to the resistance across which the voltage is applied. The right-hand diagram shows the result of current being taken in the circuit.

because two resistances in parallel always result in a resistance lower than that of the smaller.

Also the total resistance across the ends of the potential divider is reduced. But it is still quite easy to make the necessary calculation by the application of simple arithmetic and Ohm's Law.

It often happens, however, that it is simpler to approach a problem of this nature from another angle.

Instead of working with voltages and resistances only, current can be brought in to assist.

If the current flowing through the resistances is known, then Ohm's Law (voltage equals current multiplied by resistance) enables the voltage across any one of the resistances to be directly calculated.

POTENTIAL OPERATED.

Or, alternatively, voltage operated. It indicates that the apparatus referred to in this manner is operated by changes of potential.

An L.F. amplifying valve used in the normal way with negative grid bias is a potential- (or voltage-) operated device.

POTENTIOMETER.

This can be described as a potential divider with a slider (or perhaps two sliders) instead of fixed tappings. Potential dividers are generally used for distributing H.T. voltages in mains sets and units. Sometimes a potentiometer is employed for such a purpose when an "infinitely variable" adjustment is desired.

But the more common use for potentiometers is for volume controlling. We shall have a fair amount to say about this later.

PRIMARY CELL.

A device which produces electrical energy by means of chemical action, and which cannot be recharged.

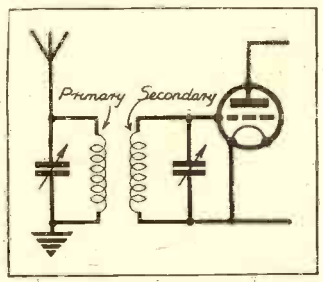
A familiar example is to be found in the so-called dry H.T. battery. Each cell of this embodies carbon and zinc electrodes, and the zinc is attacked and eaten away by the sal-ammoniac paste in which the electrodes are placed. During this process electrical energy is generated.

PRIMARY CIRCUIT.

You can think of this as the "first" circuit in an electrical circuit when the processes occurring in the circuit are followed through in a logical, ordered manner.

For instance, in "reading" the theoretical circuit of a wireless set you naturally start at the aerial and think first of the energy being developed in the aerial by the wireless waves.

Therefore that circuit in our illustration which is marked Primary is the *primary* circuit of an H.F. transformer arrangement, for the energy is passed from this circuit by induction to a second circuit (marked secondary).



The primary and secondary circuits of a radio receiver.

PRIMARY WINDING.

It follows, then, that this is that winding of, for example, an L.F. transformer into which the energy is fed, and the secondary winding is that winding from which the energy is passed on after the voltage has been either stepped up or stepped down in accordance with the nature of the transformer.

PUSH-PULL AMPLIFICATION.

Two valves are used for this in an amplifying stage instead of only one. Referring to the accompanying diagram, it will be seen that the energy is fed into the amplifier by means of a transformer with a centre-tapped primary winding.

Each of the valves is given grid bias in the normal manner.

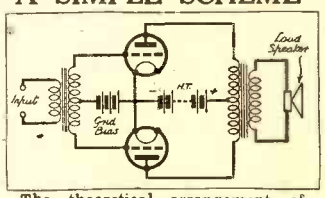
The action of the circuit is exactly as its name suggests. When the grid of one valve is made more negative by the input energy, the second valve's grid is positively affected.

Then they change over, and the first valve's grid is negatively affected while the other is positively affected.

When only the one valve is used, as in normal practice, its grid is alternately given negative and positive impulses; in push-pull each of the two valves is similarly treated, but they both work together, the one pushing as the other pulls, as it were.

The H.T. flows through the two halves of the centre-tapped output transformer (or choke), so that exactly the same amount of current is flowing through the one half in the one direction as flows through the other half in the other direction (providing, as should be the case, the valves are "matched"—i.e. have identical characteristics).

A SIMPLE SCHEME



The theoretical arrangement of push-pull amplification, showing how the two valves are connected to give one output.

The result is that when there are no signals there is no magnetisation of the core of the transformer, for the currents, flowing in opposite direction, cancel out each other's magnetising influence.

This elimination of "steady D.C." magnetisation allows a smaller transformer or choke to be used for a given inductance value, and that is one of the advantages of the push-pull scheme.

When signals are being received the current in the one half of the transformer rises (because its associated valve's grid is being made positive) at the same time as the current in the other half falls (as the grid of the other valve is being made more negative). As these currents are out of phase by 180 degrees one valve can be said to be pushing current through the output circuit as the other valve pulls it.

In this fascinating push-pull process distortion such as is met in other methods can be eliminated so long as all the conditions are correct.

Harmonic distortion is to an extent neutralised and hum irregularities are often eliminated.

Push-pull is not only applied to L.F. amplification. Various systems of H.F. push-pull and even push-pull detection have been devised.

Class B amplification is a development of push-pull, and so, obviously, is Q.P.P., for these initials stand for quiescent push-pull.

WHAT IS SCOPHONY?

A BRITISH INVENTION FOR BETTER TELEVISION

BY G. P. KENDALL B.Sc.

The word is pronounced "Scoff-ony," and its very ingenious features are clearly explained below.

IF we want to keep up with future developments it is pretty evident that we must devote some time to the study of the question of finer detail pictures in all its aspects.

How long it will be before the home constructor can take a hand in the practical exploitation of such pictures cannot as yet be guessed, but the consideration of ways and means is already of interest.

The receiving end is our main concern, of course, and here we find that we are going to be up against the old original difficulties in an aggravated form: we shall want enormously increased speed of scanning and possibly a further increase in light.

For High-Speed Scanning.

Taking speed of scanning first, much will obviously depend on the actual number of "lines" used in the improved transmission, if and when we get it. A moderate increase, as we saw in a recent issue, may be met by modification of existing gear without very great difficulty, but an increase to some such figure as 180 lines would be a very different pair of shoes.

It is probable that drum-and-disc methods would be defeated by such a transmission, and the invaluable cathode-ray tube would come into its own. Mechanical methods have a fascination for many, however, and it may be of interest to survey one which appears capable of meeting at any rate a considerable increase in scanning speed.

This is the system known by the strange-looking (and sounding !) name of Scophony. Its great interest in the present connection is that its only moving part is a very small mirror which vibrates or oscillates about its axis, a motion which can be made extremely rapid.

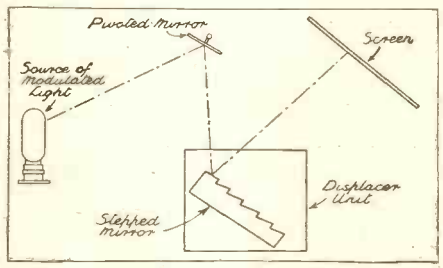
It marks really a radical departure from previous methods of scanning, for, in the true sense of the word, it does not "scan" the whole picture area at all—at least, in a direct fashion. Actually, the beam of modulated light is merely made to move to and fro, and the oscillating spot so produced is distributed over the screen area by means of what I will describe as an optical trick.

Not Easy to Explain.

This is not a very easy process to understand, and it must be confessed that most of the explanations which have appeared so far have left rather a hazy impression on the mind of the seeker after knowledge.

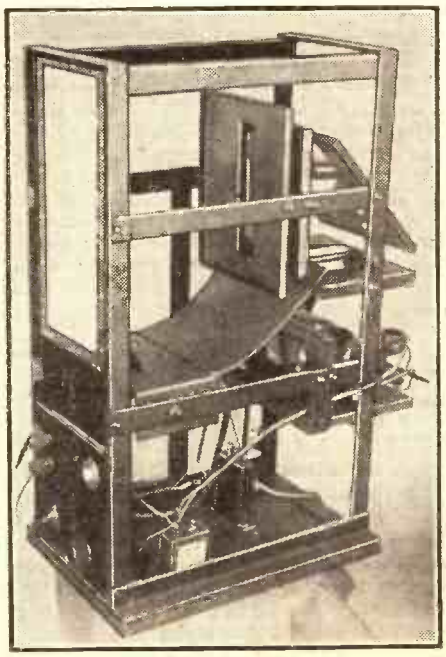
The trouble really is that to understand the business in all its details one requires a considerable knowledge of certain special optical principles and devices, and that knowledge few of us possess. To present it in a really clear form would require several articles of the length of this one, and therefore I suggest that we should content ourselves with such a general grasp of the main principle as will enable us to take an intelligent interest in the system as a whole.

We will start by supposing that we have the usual beam of modulated light, obtained either from a neon lamp or a local light controlled in the usual way by a light valve such as the Kerr cell.



THE NEW PRINCIPLE.
This sketch indicates how the spot of light from the vibrating mirror traces out a single straight line. The displacing devices, which include a stepped mirror, separate the individual elements of the picture and redirect them to their correct relative positions on the screen.

Next, imagine that this flickering beam of light falls upon a little mirror which is vibrating rapidly, so that the spot of light is made to dart back and forth in a line on the receiving screen.



IN PRACTICE.
The comparative simplicity of a Scophony receiver and absence of large moving parts, wheels, etc., are outstanding advantages of the system.

If the vibrations of the mirror are synchronised with the scanning process at the transmitter the result will be to spread the whole picture out into one long thin line, which at first sight does not seem very helpful.

But wait. Let us look at that line in more detail and see if we cannot perhaps turn it into what we want without very much trouble. To understand how the line is made up we must think back to the transmitting process and remember that the scanning operation really breaks up the picture into a series of lines or strips, which are transmitted one after the other.

Sorting Out the Strips.

In the ordinary receiving process we put these strips on to the screen in their correct positions, one beside the other, and so build up the picture again. In the first step of the Scophony method the vibrating mirror puts the strips in a long row so as to form a line containing the separate pieces in the exact order in which they were transmitted.

The fact that the pieces come in their correct relative positions gives us the clue to the next step. Instead of projecting the line of bits straight on to a screen, it is applied to a system of mirrors and lenses which deflect them so that they eventually reach the screen in the proper places.

That is just the essence of the thing, without worrying ourselves with the actual optical details, and so far I don't think it will be found very hard to follow. The difficulty really comes when we try to understand the exact working of the optical "distorting" or displacing system which diverts the various picture strips to their correct positions on the screen, and this, as we now see, is not really necessary to a general grasp of this interesting scheme.

For our present purpose it will be enough to note in passing that the heart of the displacing system is a device called a Stepped Mirror. This consists fundamentally of a series of mirror surfaces so arranged at their angles and settings in relation to each other and the rest of the apparatus that the picture strips are brought round into the desired side-by-side relation, sundry lenses completing the job.

Lightness Means Speed.

One's first reaction to this method is apt to be a feeling that it goes to a deal of trouble and complication to do something that we really don't want. It is by no means obvious why it should be helpful first to put the picture elements into a useless form and then convert them back.

However, the point of it all appears to lie in the extreme lightness and simplicity of the moving parts. Actually, the only movement required is the oscillating motion of the little mirror, for the lenses and stepped mirror of the distorting system are all fixed.

The wife of the Director of Variety—Miss Hermione Gingold.

WOMEN AS ANNOUNCERS

The latest developments in this important matter—and other B.B.C. news of interest to listeners.

ALTHOUGH the B.B.C. is non-committal about women announcers, I am pretty sure that there is a strong movement on foot inside to get women established at the microphone. But there is so much opposition to be overcome that I doubt if the change can take effect this year.

And then, if indeed the decision is taken to appoint women announcers, what will the B.B.C. do about Mrs. Borrett? Perhaps there will be a ban placed on married women.

* * *

The Board Suggests . . .

Up to the time of going to press, Sir John Reith has made no official statement in answer to the Board of Governors, who recently suggested that two women announcers should be appointed.

Since Mrs. Borrett's contract was terminated mainly because so many listeners wrote to record their disapproval of *any* woman doing an announcer's job, Sir John's decision cannot be an easy one.

* * *

B.B.C. Welcomes Inquiry.

Whatever was the case some weeks ago, there is now no doubt that the B.B.C. is not resisting the idea of an inquiry into its work on the "Crawford Committee of 1925" lines. In fact, I would not be surprised if the Governors of the B.B.C. do not urge the P.M.G. to arrange for an inquiry towards the end of next year.

The B.B.C. wants more freedom in its new Charter, and the best way to get this is through a thorough investigation—not, of course, through machinery of the "Parliamentary Select Committee" type.

* * *

Mr. Norman Takes Charge.

Mr. Norman, the Vice-Chairman of the Board of Governors of the B.B.C., is Acting Chairman during the absence in South America of Mr. Whitley. And I understand that the control exercised by Mr. Norman is far more than nominal or formal.

He is actively interested in all parts of the broadcasting organisation, and has definite views on most subjects. It is natural, however, that Talks should interest him most particularly.

* * *

Autumn Programme Changes.

As I exclusively forecast, there will be important programme changes and extensions in the autumn. The wireless trade is likely to get its requirements in the way of morning programmes for demonstration. I believe there will be continuous broadcasting from 10.15 in the morning until midnight, with more generous alternatives than at present.

The process of lightening the Sunday programmes is likely to go on, and there are good prospects of regular alternatives to late dance music on weekdays.

* * *

Regional Directors Organise.

The Regional Directors of the B.B.C. now have their own organisation. They meet periodically at one another's headquarters. This month it was Cardiff; in mid-summer it will be Belfast.

This is a good idea, and tends to develop both morale and programme standards. Mr. Percy Edgar, of course, is the chairman and assembler of these meetings.

* * *

Pay Grumbles.

Those members of the B.B.C. staff who did not get increases of pay this year are making a fuss about their being passed over. I hear there was a meeting of the disgruntled ones some weeks ago, and common action was discussed.

From what I know of Sir John Reith, I should have thought that direct personal approach to him would be much more likely to be productive of results than any banding together.

* * *

"Twenty-Two o'Clock!"

"We are sorry that we are two minutes late with the news to-night. The time is exactly twenty-one-0-two, or two minutes past nine." This will be the sort of microphone announcement which listeners will hear after April 22nd next. The use of both the old and new styles of timing will be continued until listeners are assumed to have become accustomed to the twenty-four-hour timing.

Multiples of Ten.

This is not a very difficult matter for most people, although we know of one long-service naval man, with a brilliant record in higher mathematics, who admits that he has never adapted himself easily to the expression "twenty-two hours" for the popular "10 p.m."

His mind persists in thinking in multiples of ten, which causes him to translate 10 p.m. into twenty hours—an unfortunate partiality for the decimal system.

* * *

Film Link-up.

Broadcasting and film link-up is a growing development. There is a "movie" of the B.B.C. in prospect, and John Watt, B.B.C. producer, is part-author of a film with a Ruritanian background. "Kentucky Minstrels," Harry S. Pepper's microphone revival, is also being spoken of as a musical film, while Leslie Sarony, broadcasting star, is lead in a recently completed film with an all-star cast.

* * *

A Television Treat?

Leslie Sarony's record song hits include "I Lift Up My Finger and I Say 'Tweet Tweet'" and that humorously mournful "Ain't It Grand to Be Bloomin' Well Dead?" When television is in all our homes maybe we shall see him as the climbing monkey or with Leslie Holmes in a demonstration of ventriloquism. These two hilarious "turns" have hitherto been reserved for the delectation of their intimates; but they deserve a wider public.

* * *

Henry Hall Broadcasts.

So Henry Hall and the B.B.C. Dance Orchestra are to continue to provide the late evening dance music on Saturdays.

This important decision is based on the expressed opinions of a large body of listeners that the type of show which Henry and the boys (assisted very ably by other people) have been giving for some weeks is much preferred to a solid hour and a half's dance music.

* * *

On Saturday Night.

It is difficult to break from tradition, but, after all, it may be as well to have a change from the type of dance music given on every other weekday night.

Saturday night is the right time for people to sit up late, and Henry Hall is going to make it worth while with lively music, variety turns and what really amounts to cabaret shows. **O. H. M.**

NATIONAL FEATURES YOU'LL WANT TO HEAR

ORCHESTRAL. The Grand Hotel, Eastbourne, Orchestra, directed for the first time by Leslie Jeffries. (Sunday, April 22nd.)

DRAMA. "Will Shakespeare," a play by Clemence Dane in honour of Shakespeare's birthday. (Tuesday, April 24th.)

VARIETY. "Old Music Halls." No. 6 in the series arranged by Willson Disher, deals with the Empire. (Thursday, April 26th.)

SPORT. The Cup Final. Running commentary by G. F. Allison, from the Wembley Stadium. (Saturday, April 28th.)

HIGH LIGHTS FROM THE REGIONS

LIGHT MUSIC. "Frederica." A broadcast adaptation of the successful light musical play. (London Region, Tuesday, April 24th.)

BAND. Brass Band Concert relayed from the Manchester Grocers' Exhibition (North Region, Thursday, April 26th.)

VARIETY. "Regional Revellers" concert party giving another of their popular shows. (Midland Region, Friday, April 27th.)

OPERA. "Cavalleria Rusticana." Mascagni's musical melodrama in a studio performance. (Belfast, Saturday, April 28th.)

"THAT we may look back on the way we have come and forward to the summit whither our way lies"—a resting-place.

It is grand to stop, on a mountain climb, and look over the wide country above which one is so arduously poised. It is good to look down the path one has made and remember, rather proudly, how this or that difficulty was overcome. But one's head turns, and the upward climb is there still. One goes on, inspired by the knowledge that, since much has been achieved, further achievement is possible.

* * *

I heard my first wireless signals around 1904. I mostly heard the sound of the spark, but, intimately, a little whisper, down in the dark interior of an earpiece, told me that there was more to be understood than just crackling. I do not want to tell tall stories of the great discoveries of yore, because I think much better work is being done to-day than yesterday. Nor do I want to disparage the work of pioneers who had great faith. On the other hand, I have noticed that faith has a habit of creeping into the gaps left by knowledge.

* * *

Of course, wireless became really important after the invention of the thermionic valve. The thermionic valve made wireless a competitor with the cables. I wonder if you realise how this came about. It is rather subtle: almost as difficult to understand as the reason why it has ceased to be a competitor with the cables.

Huge Aerials—and Static.

The receiver of pre-valve days used an aerial and a detector—crystal, magnetic, coherer, electrolytic, whichever you liked; but there was no amplification. When, for example, Carnarvon communicated with Glace Bay, the receiver used huge aerials and got huge atmospherics. The engineers found that the longer the wave the clearer the signal, but the worse the atmospheric. So they lengthened the wave, increased the aerial size and increased the power. Stations got into the thousand-kilowatt idea (if never the actuality) and waves became so long that they were audible in telephones connected direct to the aerial—i.e. without rectification. Indeed, Bordeaux Lafayette (wasn't it?) had a frequency of carrier-wave below 20 kc./sec!

HOW THE VALVE REVOLUTIONISED RADIO

Then came the valve. It was of no use really to the long-wave receiver. It amplified, but it amplified the atmospheric. It wasn't that the signals were too weak any more: they could be amplified, but so could, and was, the atmospheric.

Escaping From Interference.

Then someone (never mind who, because that always starts a silly argument) started to use "short waves" (never mind how short either, because that creates bad blood, too). And, provided you used valves in the receiver, you heard these signals over astonishing distances. And, moreover—and this is the whole point—atmospherics were of negligible strength compared with those heard on long waves.

If, in the pre-valve days, we had used short waves, neither the signals nor the atmospherics could have been heard. Just a complete silence. Because the short-wave signals are very weak. The valve enabled one to detect these very weak signals. This would not have been of any help if the atmospherics on short waves had been strong. But they are not; Cosmos has seen to that. So we can amplify weak short-wave signals and hear them clearly.

It is no good amplifying strong long-wave signals, because these are drowned in atmospherics, and we could never make them powerful enough to overcome these atmospherics unless we had millions to spend. But a few kilowatts on short waves is enough to give a station a range of "pi times the radius of a well-ordered world," and who wants more than that?

There is always a fly in the ointment. In spite of the wonderful range of short waves, they cannot be relied upon during 24 hours of 365 days in every (not leap) year. They just stop being signals every now and again, both the now and the again being decently predicable in hours, days and years, and the sun's spots being a contributory factor. But the short-wave communicator is very useful because, in general, you can assume service during 10–20 or even 22 hours out of the average 24.

* * *

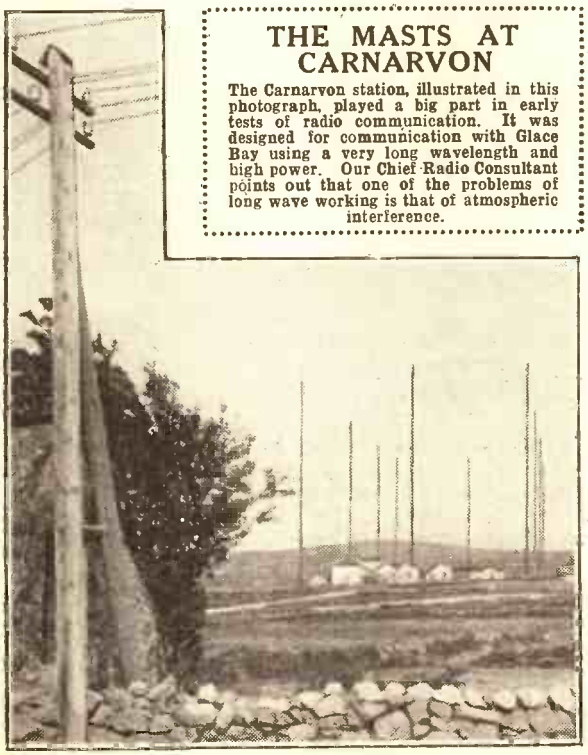
But the valve has done more than "make" wireless. It has made the wire. So much so that if the world was sane much of present wireless could be given up. A sane world would say: "You must use the wire whenever you can; but when you can't, use wireless."

Why Not Use "Wire"?

There are too many vested interests, bureaucratic as much as private, to allow such a sane thing to be said, much less done. But the valve and the wire can link every individual on a continent, and that's a far more wonderful achievement than linking up elaborate single stations one with another. Broadcasting is, of course, a distinct "wireless" achievement, but it could be better and more fully done for the urban listener by using the (uncensored) wire.

Wireless is useful to link up continents (somewhat inadequately when speech is involved), to link up mobile units which cannot attach themselves to wires (ships, automobiles, etc.) and to reach the lonely listener who at present is not economically "reachable" by wire.

Yes, we have come a long way; the summit's a bit obscure; but the next part of the path is very clear! Clear to all who are not "resting."



THE MASTS AT CARNARVON

The Carnarvon station, illustrated in this photograph, played a big part in early tests of radio communication. It was designed for communication with Glace Bay using a very long wavelength and high power. Our Chief Radio Consultant points out that one of the problems of long wave working is that of atmospheric interference.

HENRY HALL'S £1,200

FOR ONE WEEK'S VARIETY APPEARANCE WITH HIS ORCHESTRA

THE periodic squabble between the B.B.C. and various music-hall interests are only the concern of listeners in so far as they actually affect the quality of the programmes. If the fact that Mr. Black, of the G.T.C., has a temporary "down" on broadcasting means that we do not hear—shall we say?—Layton and Johnstone, then we have a justifiable right to know what is being done about it.

Two-Hour Variety.

But there is one programme every year which even the bitterest quarrel should not be allowed to spoil—the Royal Command Variety Performance.

Last year it was decided not to broadcast that show owing to the large percentage of items which depended upon the sight for their enjoyment. Thousands of listeners wrote to protest, a lot was written about Mr. Black "forbidding" the broadcast—and the B.B.C., as usual, just sat tight and said nothing!

On May 8th this year, however, listeners all over the country are to have the chance of hearing a two-hour programme, called "A Royal Night of Variety," including the finest vaudeville artistes in the country.

For this privilege the B.B.C. are paying 500 guineas to the Variety Artistes' Benevolent Fund.

"SAY IT WITH MUSIC"

Jack Payne, Henry Hall's predecessor at the B.B.C., saying it with music from one of the new Ekco Model 74 superhet receivers.

A Tribute To Radio.

Many rumours have been circulated that the Royal Command Performance this year will see Henry Hall and the B.B.C. Dance Orchestra playing before their Majesties the King and Queen.

Not only would this be a tribute to radio, but it would also be a most popular move from the point of view of the public. The enthusiastic welcome given at Radiolympia last year to Henry Hall was a surprise even to the most optimistic publicists of the B.B.C.

But there was a snag to Henry Hall's appearance at the Palladium on May 8th.

(*Continued at top of next column*)

(*Continued from previous column*)

The B.B.C. Dance Orchestra is *not* a recognised variety "turn," having appeared nowhere except under the direct management of the B.B.C.

An Amazing Fee.

A generous gesture by Mr. Black has put all this right. The B.B.C. Dance Orchestra has been given a contract to appear at the London Palladium for a week in July at the amazing fee of £1,200. This is one of the largest fees ever paid to a British stage act, and is a striking tribute to the popularity of Henry Hall.

The Entertainment Tax —and Licence Figures

THE campaign now in progress to reduce the Entertainment Tax for theatres and cinemas takes no account of the position of radio listeners.

Out of every 10s. licence fee paid very nearly 6s. goes to the Treasury. Of this Treasury share 4s. 5d. is a direct tax on radio entertainment—a tax which amounts to nearly 45 per cent!

What other entertainment industry is treated one half as harshly?

The opinion of the theatre and cinema people is that, since radio has helped to put them in their present position, radio entertainment should be the last to be given any form of relief.

But has broadcasting had the effect of driving people away from places of entertainment? An analysis of the latest licence-figure returns would seem to prove definitely that it has not.

The figures show that the larger the town the smaller the proportion of licences!

In London, for instance, with its 8,000,000 or so people, there are only 900,000 licences—or 9 licences to every 80 people. In Liverpool there are 16 licences to every 85 people. In Birmingham the proportion is 9 to 50.

But take the figures for some of the small country towns, and what do we find? A Cornish town with 2,500 inhabitants has 1,500 licences—or more than 1 licence to every 2 people! Wokingham, in Berkshire, can show 4,141 licences for a population of 7,294.

These figures, taken from the "Broadcaster," would seem to show that, in towns where plenty of entertainment is offered, radio has not nearly such a big hold as in the smaller places, where Henry Hall, the morning service, the news and so forth are the only diversions.

HERE AND THERE

Radio items gathered from up and down the country.

THE situation imagined by Val Gielgud and Holt Marvel in their new radio thriller, "Death at Broadcasting House," was recently brought into the realms of actual fact when listeners to the Tiflis station—in the Caucasus—heard the murder of an announcer who was asking inhabitants of the town to help in the search for a bandit.

* * *

The announcer had just started describing the wanted man when bullets fired from the street outside were heard crashing through the studio window.

PUT YOUR CLOCKS ON!

On Sunday, April 22nd, Summer Time comes into force. Remember to put your clocks and watches *forward* one hour on Saturday night.

THE 24-HOUR SYSTEM

On the same day the B.B.C. will introduce the 24-hour system of timekeeping for all its programmes.

There is nothing difficult about this. The hours before noon remain unchanged. 9.30 a.m. is 9.30; 11.45 a.m. is 11.45. Only the "a.m." is dropped. After noon just add 12 to the ordinary hour and drop the "p.m." Thus: 9.30 p.m. becomes 21.30; and 11.45 p.m. becomes 23.45. Simple, isn't it? Or isn't it?

"I am hit!" cried the official into the microphone, as he collapsed dead on the floor.

* * *

Droitwich Starts Testing.

The new high-power, long-wave station at Droitwich is to start its first tests next month, in preparation for the official opening—possibly by a member of the Royal Family—in July.

* * *

The most serious part of this change-over will be that, since the London National, North National, and Western National will all be closed down, listeners will only be able to receive the National programme on the long waves. And thousands upon thousands of listeners cannot hear anything on the long waves without terrific interference.

* * *

U.I.R. to Meet in London.

Important changes may arise out of the meeting in London of the Union Internationale de Radio-diffusion in June. Russia and America will be represented among the delegates, who will number nearly 150 and will meet under the presidency of Admiral Sir Charles Carpendale of the B.B.C.

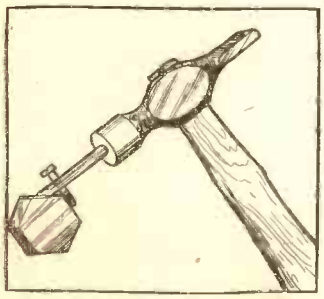
* * *

Not only technical questions, but also legal matters concerning copyright and exchange of fees between broadcasting concerns throughout the world will be discussed at this meeting by the largest gathering of broadcasting experts ever seen.

Recommended WRINKLES

FOR LOOSENING NUTS.

THIS gadget is made from a piece of ¼-inch steel, one end of which is rounded and the other notched with a file. A hole is drilled about ¼ inch from the notched end and tapped to take a small set screw. This end is then case-hardened.

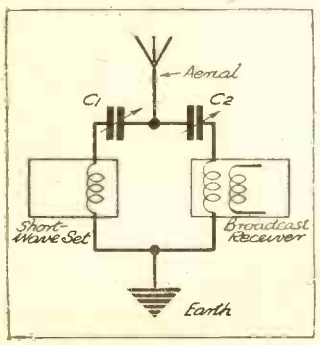


Even the most stubborn of bolts, as well as nuts, can be dealt with.

In use the notched end grips the face of the nut with which we are dealing, and, the set screw acts as a stop, preventing the tool from slipping. Unlike the chisel, this does not dig into the nut, and the defacement is only slight.

TWO SETS—ONE AERIAL.

RECENTLY several people have asked me if it is possible to use two receivers on the same aerial at the same time. In the case of two broadcast receivers this is not really advisable; but when one is a short-waver and the other a normal broadcast receiver, quite good results can be obtained.



How the two receivers are coupled up.

If you have a look at the accompanying diagram you will see the arrangement. For best results it is essential that the two series-aerial condensers, C1 and C2, should be really small—·00005 mfd. is a good value.

A NOVEL STATION INDICATOR.

QUITE a number of keen experimenters have provided for their families a purely local-station receiver which selects either the National or Regional programme by a turn of a switch.

A refinement which most old folk appreciate is some form of signal lamp that will show at a glance to which programme the set is switched. One way is to have small flash-lamp bulbs wired to extra contacts on the "station-change" switch, each one differently coloured so that you have, for instance, green for National and red for Regional.

It is, however, much better if the actual words "National Programme," are illuminated when the set is switched to the National wavelength.

Suitable indicating signs can be very simply contrived by any possessor of a plate camera in the following way:

The words "National Programme" and (for Londoners) "London Regional" which appear at the tops of programme pages should be "isolated" from the rest of the printing at the top of the page by liberal use of white paint, thus leaving the words in bold relief on a dead-white background.

A photograph is then taken of the words, and when doing so they should appear on the camera's focusing screen the size they are required for mounting on the set. A generous exposure should be given, and subsequent development should also be on the generous side.

When the plate has been "fixed" and dried it will at first glance appear as if it is black all over; but when illuminated from behind the letters of the photographed words will be easily readable.

If the two plates are carefully mounted on the receiver's panel with the signal lamps (screened from each other, of course) behind them, nothing will be seen on either of them until the set is switched on, when the letters "National Programme" will "miraculously" appear if the set happens to be switched to the National station.

PREVENTING SAG.

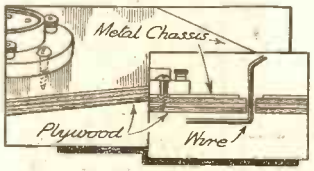
WHEN an outdoor aerial is erected such precautions as coating the mast with paint or creosote and burying it well into the ground to resist the high winds and varying weather conditions are seldom overlooked. Yet, in spite of this, sagging of the aerial is sometimes experienced after a comparatively short time, due to the use of cord or rope for fixing.

An excellent method of overcoming this is to substitute wire for the rope, and it is a good scheme when obtaining the aerial to order a few feet extra for this purpose.

FOR METAL CHASSIS.

CONSTRUCTORS who are changing to a metal chassis sometimes find they have plenty of wood screws, but no nuts and bolts to fix the components. The difficulty can be overcome in this way:

Drill the chassis to clear the wood screws, and then place underneath the chassis a piece of plywood. The wood screws can now be used to fix the parts, as in sketch.



How components may be fixed to a metal chassis by wood screws.

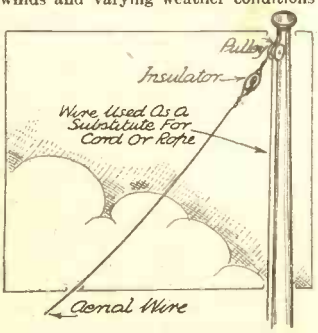
ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best wrinkle from a reader, and others published will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

The best Wrinkle last week was sent by H. Bracegirdle, 20, Maple Avenue, Haydock, to whom a guinea is being awarded.

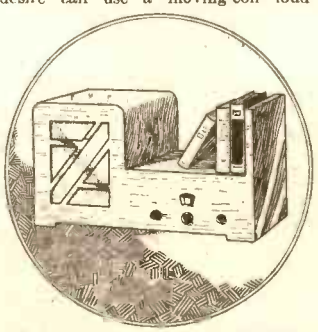


Aerial wire may be used instead of rope as a halyard.

Also, where wires come up through the chassis, a large hole should be drilled in the metal, but a small one in the wood. The latter will act as a bush and stop wires shorting on the metal.

AN ATTRACTIVE CABINET.

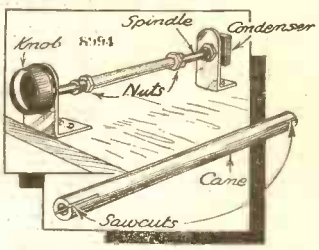
READERS who are looking for something new in cabinet designs will be interested in the sketch attached. It incorporates a moving-iron loudspeaker and the POPULAR WIRELESS "Pop-Vox" set. Of course, those who desire can use a moving-coil loudspeaker or some other "P.W." set design. The actual proportions can be altered to suit each individual case.



A book rest is combined with this pleasing receiver cabinet.

EXTENSION SPINDLES FOR PANEL CONTROLS.

A LENGTH of bamboo cane, such as is sold for children's fishing nets, is purchased and a piece about the size of your condenser spindles is chosen.

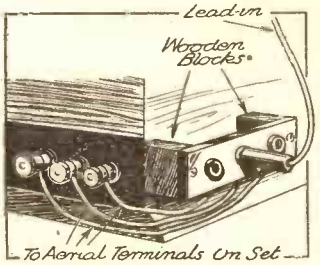


Short lengths of cane are particularly useful when used in this way.

Cut the cane close to the joints, picking the straight sections. Each piece should be about 4½ to 6 ins. long. Next make a saw-cut down the length, about ¾ in., as shown in the sketch. Push a nut off an old condenser bush over each end, then push the cane over the spindle of condenser and knob and tighten up. The nut will bite into the hard outside of the cane and cut a thread of its own.

ALTERNATIVE AERIAL TERMINALS.

THERE are many sets in which two, or sometimes three, aerial terminals are provided in order that adjustment may be made to secure a sufficient degree of selectivity to suit local requirements. It frequently happens, however, that one wishes to change the aerial connection to provide either maximum volume on the local programme or extra selectivity to receive clearly some distant station.



Simplifying the changing of the aerial input from one terminal to another.

These terminals are usually at the back of the set, and more or less inaccessible, but the gadget shown in the illustration provides for instant adjustment whenever required without fiddling with terminals. Each aerial terminal is connected by a short flexible lead to each of three small sockets, mounted on a piece of ebonite which is fixed either to the side of the cabinet or to the wall, while the aerial lead-in terminates in a suitable plug which can be plugged into any tapping at will. Alternatively, a 3-stud switch arm could be used. No electrical inefficiency results from this scheme.

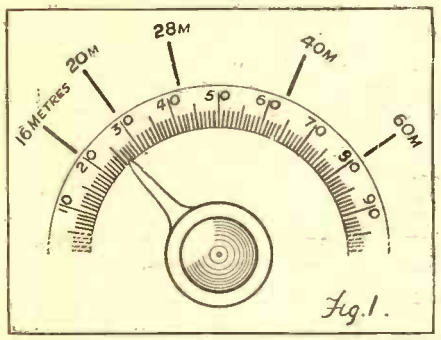
I HAVE chosen rather a vague title for this page, as there are certain things about short waves that one *must* say occasionally and that cannot be grouped under any particular heading.

I have come to the conclusion that we are rather apt to dismiss short waves as a small branch of radio, when, in reality, they embrace every single problem, every single aspect of radio technique. They are, in fact, an entirely separate field, to which we have to apply all that we have already learnt about radio.

No one realises more than I do how much development work has taken place on the medium and long wavebands during the past two years. No one realises more than I do the sad way in which the short waves are lagging behind.

All the improvements that have been made in broadcast receivers during the last two seasons will eventually be applied to short-wave work; but there is bound to be a lag, for the simple reason that we short-wave enthusiasts have other problems to deal with first.

A CROWDED DIAL



When wavelengths come as close together as this on a tuning dial it indicates that the condenser's capacity is too large. (See next page.)

Catering for Everybody.

In my own humble way, in this little short-wave section, I have to cater for the entire "clientele" of "P.W." at some time or other. I like to flatter myself that every single reader of "P.W." has, at some time or other, shown a passing interest in short-wave work.

But the difficulty arises when I have to write simultaneously for the novice, the "graduated novice," the expert and the interested spectator who won't have anything to do with the game.

RANDOM JOTTINGS

A causerie of short-wave items which do not fall under any general category, but which are, nevertheless, of vital importance.

People write to me in this strain sometimes: "Dear W. L. S.,—Why don't you leave off all this blather about single-valve sets and design us a really good short-waver? We want two H.F. stages with screened pentodes and automatic gain-control, ganged with the detector, totally screened, all waves on one swing of the dial and freedom from outside interference."

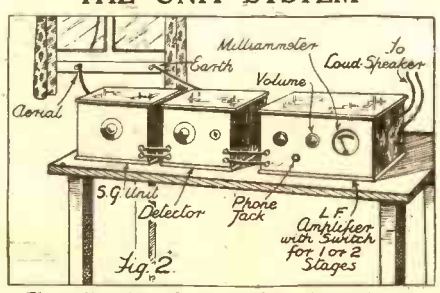
To these letters I mentally reply: "My Dear Old Thing,—You don't want much, do you? Just you learn, first of all, to make the best of what you've got, and then we'll set about producing something better for you." That, of course, is only the mental reply.

An Excellent Method.

The actual reply (coming, of course, from a polite person like myself) reads: "Dear Sir,—With reference to yours, etc., etc., we will certainly consider the construction of such a set, but would respectfully point out that several difficulties have to be overcome before the design is finally perfected, etc."

I know only too well how many struggling readers there are who find it a matter of some difficulty to construct a simple two-valve short-wave set that really will deliver the goods. I would cheerfully take on a bet as to the proportion of readers who use "singles" and "twos"—I should estimate it at 90 per cent at the very least.

THE UNIT SYSTEM



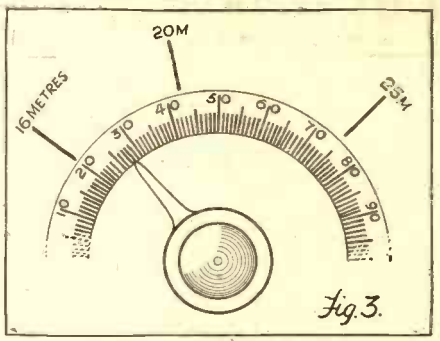
The unit system of construction, at one time so popular on broadcast waves, still has much to recommend it for S.W. work.

Now for a suggestion. Years ago some brainy lad invented what we called the "Unit System." One simply started with the basis of a wireless set, which was, is and always will be a detector stage.

When one had finally got the hang of the thing, one added either an L.F. stage at the back door, so to speak, or perhaps an H.F. stage at the front door.

I very strongly recommend any short-wave enthusiast who hankers for bigger and better sets to get to work on these lines nowadays. The first thing is to make a detector work. It's harder to do that on its own than with the help of an L.F. stage on the end; but that's all the better, because you *will* have it working decently by the time you are satisfied.

GOOD SPACING



Compare this diagram with Fig. 1. It shows the wavelength disposition with a correct inductance-capacity ratio. (See next page.)

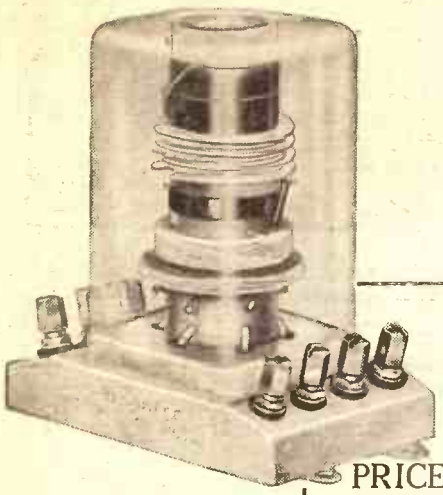
The Next Stage.

Having got so far, you can add a note mag., or, if you feel a little more adventurous, you can build a screened-grid stage, the construction of which will be the subject of an early article in this section.

Doubtless this reactionary suggestion of going back to 1924 principles will annoy the highbrows intensely. But who cares? It is the only way to *learn*—this business of tackling a thing from first principles.

If you settle down and build, to a cut-and-dried design, a three-valve short-waver the chances are that you will get excellent results. But you won't know whether they are as good as they *might* be.

If you become "unit minded" and proceed along the table in the manner of Fig. 1 on this page, you will have the immense satisfaction of knowing that each section of your set is doing its job well



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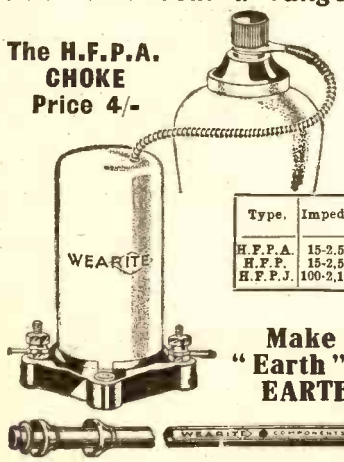

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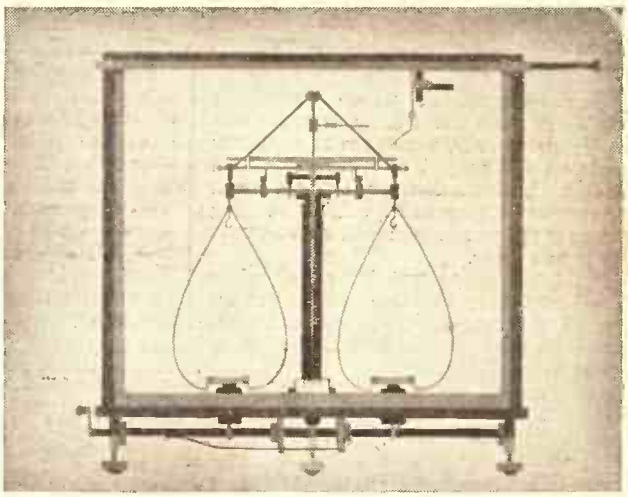
♡ 4868

ACCURACY



Chemistry or Radio—milligrammes or microfarads—accurate values are indispensable to successful working. That is why it is so important to equip your set with T.M.C. HYDRA condensers—*they are accurate and remain accurate.*

Strict scientific control of every manufacturing process ensures the accurate rating of every T.M.C. HYDRA condenser, and a perfect method of sealing prevents penetration of moisture, so maintaining the high electrical properties of the condenser.

Improve the working of your set with T.M.C. HYDRA condensers—they are made in all standard capacities with screw terminals or soldering tags at the same price.

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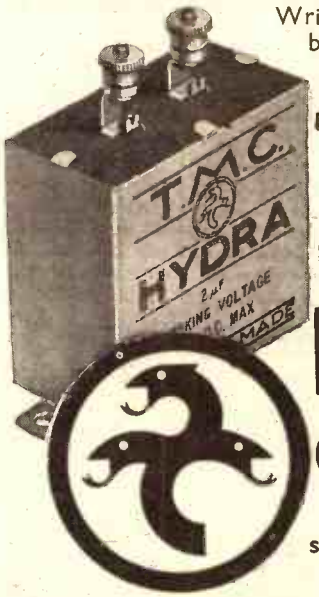

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On the Short Waves—(*Continued from page* 138.)

W. J. (Ramsgate), whose experience of short waves dates back for one week only, wants me to say a few words on the subject of "cramping" on the dial. The two sketches on the previous page represent, respectively, W. J.'s tuning dial as it appears to him and as he would like it to appear.

Fig. 1, showing something rather wider than 16–60 metres on one dial, is not his idea of fun, nor mine either! An ideal spread for the lower band would be on the lines of Fig. 3.

As a matter of fact, W. J.'s trouble is simply the use of far too large a tuning condenser. He is using ·00035 across a biggish coil. Owing to the fact that his condenser is a very good one with a very low minimum, he manages to get down to about 16 metres with it.

Decreasing Capacity.

I have already made it clear that I don't think one should ever use anything bigger than ·00015 or ·0001. Figs. 4 and 5 (below) show an easy method of evolving a short-wave condenser from the junk box.

Fig. 4 represents an end view of the average ·0005 condenser. With half the plates removed and the rest double spaced, as in Fig. 5, the capacity is reduced to something rather less than a quarter of the original—something in the region of ·0001. The whole job can generally be done in half an hour.

What Readers Want to Know.

Now for some "potted answers" to the more interesting queries in the post-bag.

D. C. S. (Whetstone).—Can't identify B H I T 2 or B G D I 2. G E K is a British R.A.F. station; F Y T is, I believe, in French Equatorial Africa; L L C is a Norwegian commercial. For a *regular* amateur transmission on 5 metres, see "Short-Wave News" on this page.

Your 15-metre station with the musical interval signal "F A C F" has been heard but not identified.

H. R. H. (Walthamstow).—Have heard nothing about a club in your district as yet, but will let you know if I do.

A. W. (Manor Park) sends me a history of his short-wave career, including an incident which must be so common that I am quoting it in full. When he was a very raw novice A. W. had a set that apparently was given to oscillating really hard.

You all know the "supering" effect that such a set will go into. After passing the real oscillation point you come to what seems like another one, beyond which the set is operating with a continuous high-pitched whistle.

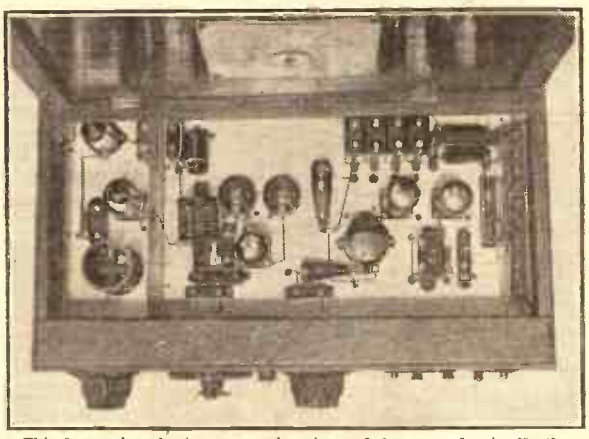
For quite a long time A. W. worked his set in this state, thinking that the whistle was a necessary adjunct to short-wave work and had to be put up with! Then one day he bought a new set of coils, and to his disappointment the set wouldn't howl!

A Radio Sherlock Holmes?

Soon, however, he found the real oscillation point. It was a bit ploppy, but after perusing more articles in "P.W." he sallied forth and bought a 5-megohm grid leak, after which all was well. Short waves have been his meat ever since. I wonder just how many readers have gone through this same series of occurrences?

A. W. concludes by making a startling exposure of my identity, which shows that he has also leanings towards the sleuthing fraternity.

A CAREFULLY PLANNED DESIGN



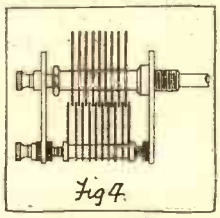
This four-valve short-wave receiver is used by a reader in North-West India. A view of its panel was published in the March 17th number of "Popular Wireless."

No fewer than six different readers have written asking me for full descriptions of a short-wave transmitter! I'm afraid my answer must be that this is right outside the province of these notes, and also that it is not quite so easy to obtain a transmitting licence as some people imagine. Furthermore, the "easy" way—transmitting *without* the said licence—leads to certain destruction, for our G.P.O.'s efficiency in these matters is positively uncanny.

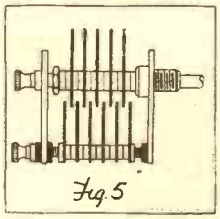
Sorry, but there it is! I can't possibly deal with transmitter designs in these columns, and, seeing that there are only twenty-four hours in one day, I can't answer them all by post.

By the way, to obtain a licence you must convince the G.P.O. of your familiarity with transmitting circuits, operation and general radio qualifications. In addition, you have to pass a Morse sending and receiving test.

FOR BETTER TUNING



An ideal tuning condenser for short-wave reception may be made by converting an ordinary "variable" in the way indicated by these two diagrams. All you have to do is to dismantle the condenser and remove every other plate, both fixed and moving, and reassemble with double spacing between the plates.



AS a sequel to my request for addresses of short-wave clubs I have received the following: The Glasgow and District Radio Club will welcome all new members interested in short waves, who are asked to apply to the Secretary, Mr. Henry Duff, 90, Budhill Avenue, Shettleston, Glasgow, E.2.

F. G. S. (N.16) sends news of a special DX Club broadcast run by W 8 X K every Monday morning from 05.30 to 06.00 G.M.T. W 8 X K, at that time of the morning, is on his 48·86-metre wave, and also sometimes on 19·72 metres.

Reports, items of news and "hints and tips" suitable for broadcast should be sent to Edward C. Lisp, K D K A–W 8 X K "D X" Club, William Penn Hotel, Pittsburg, Pa.

London 5-Metre Station.

Here is some definite news about a reliable 5-metre transmission which will be of interest to London readers: Mr. A. E. Wood (G 5 A W), of Streatham, S.W.2, will transmit on the 5-metre band every Monday evening, until further notice, from 10.45 till 11.15 p.m. (G.M.T. or B.S.T., whichever is in force).

The transmissions will make use of a distinctive tone which will vary slowly in frequency between 800 and 1,200 cycles. When the call-sign is being sent in Morse the tone will be kept steady at 1,000 cycles. Gramophone records and announcements on telephony will be transmitted at about 11.7 p.m.

Getting Ready for Summer.

G 5 A W's station is very favourably situated on high ground and should have a very good range. I hope to have news in a week or two of further schedules. It is time that all the 5-metre folk were brushing up their gear ready for the "big push" this summer.

The Spanish station E A R 58, working on 40·8 metres approximately, has changed its call to E A 8 A B, and may be heard most evenings at 11 p.m. or earlier.

The first chance to log a station in Hawaii has arrived! The commercial station K I O has been heard on 25·5 metres transmitting speech and records. It is reported that it is possible to hear him at about 6 a.m.

One of the best and most reliable stations on the 45–50-metre band has always been W 3 X L, Bound Brook, on 46·69 metres. I understand that he is now transmitting occasionally on 17·3 metres as well. W 3 X A L, also at Bound Brook, is, of course, well known.

W. L. S.

The PEN-DET

This short-wave two-valver, designed and described by W. L. S., uses a pentode as detector to ensure absence of background noise and maximum efficiency before the L.F. amplification.

I DON'T suppose I have ever written an article about a short-wave receiver without devoting some space to that all-important question of "background." This is going to be no exception, but I am approaching it from what I imagine to be a new angle.

Let us dispose of this background business right away. If we start off on short-wave reception with a reasonably selective detector alone we find that we are obtaining just about the best ratio of signals-to-background noises that we can get. Signals are not particularly strong, but the general "mush-level" is so low as to be almost unnoticeable.

Applying Amplification.

Those of us who want to listen to short-wave telephony in comfort generally add an L.F. stage to such a set. This gives us considerable amplification of our signals, but at least an equal amount of amplification of the unwanted "mush." If the amounts really were equal we should have nothing to complain of except the discomfort of listening to even a loud signal through a noisy background. But the trouble usually is that the mush, being a nondescript collection of unwanted emanations occupying almost the whole range of audible frequencies, invariably comes up just a *little* more in strength than does our wanted signal or station.

In addition to this, each new valve that we add to the set actually *generates* a little mush all on its own. Filament noise is one source, and there are several others, but luckily for us all the total is very minute.

We have, however, to face the sad fact that the ratio of signal to mush becomes more and more unfavourable as we add succeeding valves to our set.

Resistance-Capacity Coupling.

Transformer coupling is probably the worst culprit in this way. I don't pretend to know where all the extra "hiss" comes from, but I believe some of it is due to the pick-up of powerful long-wave transmissions on the primary of the L.F. transformer, which is, after all, loosely coupled back to the aerial.

The obvious solution to this difficulty is to use resistance coupling. Here, however, we are faced with the fact that the amplification from a single stage may not be great enough to give real headphone comfort on stations that are really weak.

Every practical point affecting success has been considered carefully by the author, and his description of the design is, in itself, a valuable guide to world-wide reception on the short waves.

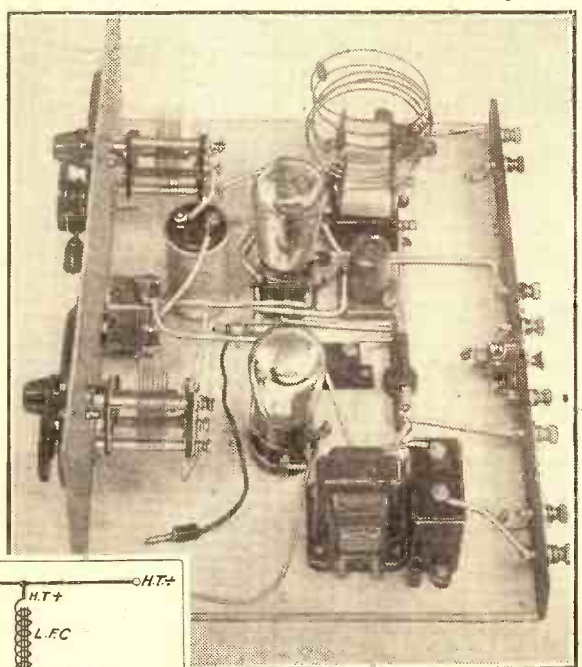
Imagine, then, that we have a set comprising an ordinary leaky-grid detector and a resistance-coupled L.F. valve, and that we want some more amplification without spoiling the quiet background. How can we get it? We can take away the R.C. stage and substitute a transformer-coupled stage—a very bad way of doing it, as I have already said.

We can use a pentode instead of our output triode—not so bad, but still not all that it might be. We can add a third valve—probably the worst procedure of all, unless we are content with receiving the really loud stations at good loudspeaker strength and letting the others go.

Lastly—and, when one comes to think of it, the most obvious solution of all—we can stop worrying about our "note-mags." and improve the sensitivity of the *detector*.

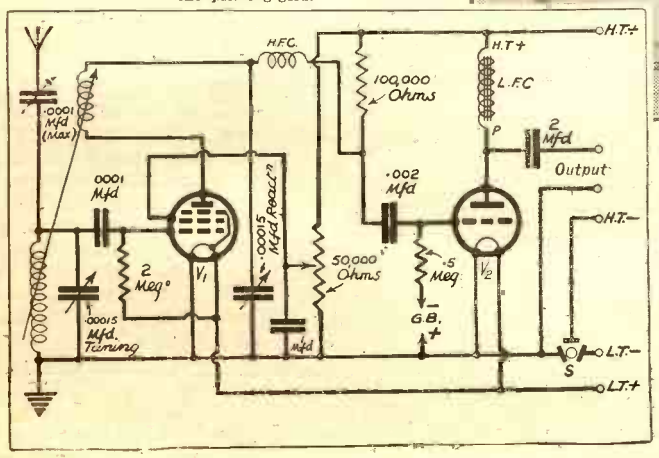
After a lot of experimental work with a skeleton two-valve receiver I quite made up my mind that the best results I had ever obtained with it were produced by using a

(*Continued on next page.*)



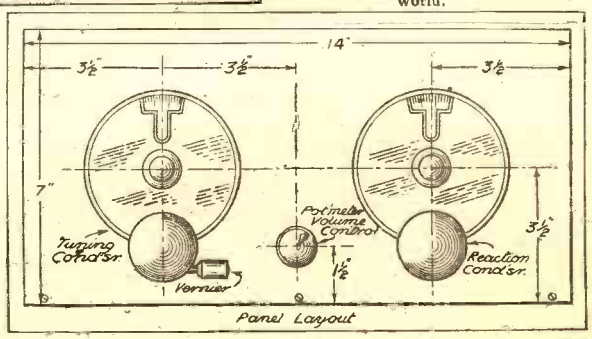
STUDIED SIMPLICITY.

Our contributor's unique success in this short-wave design is not due to the use of costly and complicated apparatus, but to studied simplicity which results in ease of construction and handling. With the set completed as shown, the connection of batteries, etc., places the owner in direct touch with interesting stations all over the world.



FIVE-ELECTRODE DETECTOR.
By using the pentode as detector a smoothly graduated control of reaction is obtainable by means of the slider of the potentiometer that regulates the voltage on the priming grid.

The metal panel is drilled as shown in the sketch to the right.



THE "PEN-DET."

(Continued from previous page.)

pentode detector and a triode output valve. Accordingly, I rebuilt the set in more presentable form, and here it is. For those who want noise (or, perhaps, loudspeaker reproduction) there is an easy way of producing it—simply use *two* pentodes, one as detector and one as L.F.

The sensitivity of the ordinary output pentode as a short-wave detector is rather amazing. But it was not entirely from the sensitivity point of view that I decided to use one. By making the priming-grid voltage variable one has an extra control that will do all sorts of useful things.

It can either be set at a suitable voltage and left alone, or it can be used instead of the normal reaction control, or, yet again, it can be used as a *volume* control after a telephony station has been properly tuned in.

Perfectly Stable Without Decoupling.

The pentode detector is well suited to resistance-capacity coupling, which, incidentally, is a very convenient means of reducing the detector anode voltage to a suitable figure without recourse to an extra tapping on the H.T. supply. I found this set perfectly stable without any attempt at decoupling whatever.

Referring to the circuit diagram, we may dispose quickly of all the theoretical points. Two plug-in coils are used for the detector-grid and reaction circuits, the aerial being capacity coupled to the top end of the grid coil through the customary preset condenser with a maximum of ·0001. Most of these condensers have a minimum of the order of ·000006 (five noughts six), and will produce a sufficiently loose degree of coupling for general requirements.

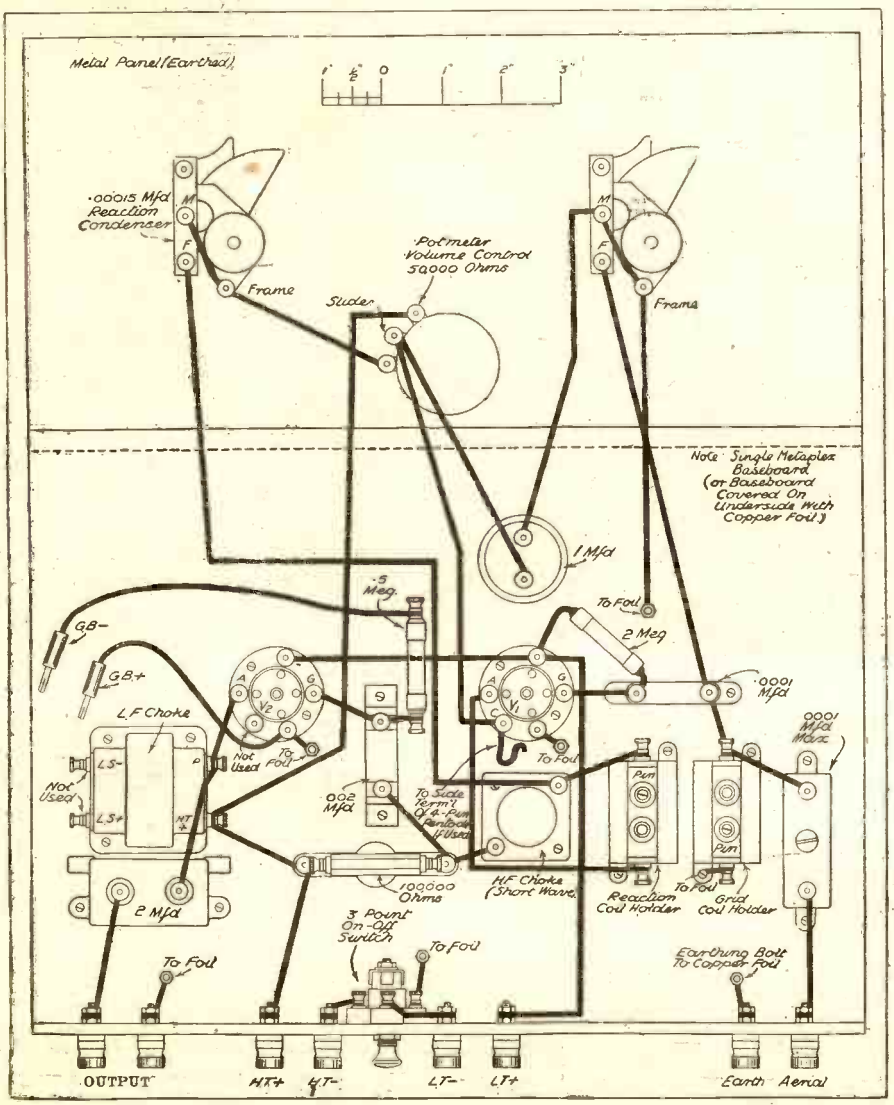
The detector-grid circuit is tuned by a ·00015 condenser with a slow-motion dial equipped with a vernier adjustment. A similar condenser with an ordinary slow-motion dial serves for reaction control. These are symmetrically mounted on the front panel, which is of metal, and make for very easy control of the set. Slow motion on the reaction control is decidedly worth while.

The only other control on the front panel is the potentiometer for adjustment of the pentode priming-grid voltage. This has a value of 50,000 ohms, and is connected across the H.T., with the slider connected to the priming grid and by-passed to earth through a 1-mfd. non-inductive condenser.

RECOMMENDED COMPONENTS

- 2 J.B. ·00015-mfd. short-wave "special" tuning condensers.
- 2 Igranic 2-pin coil holders, or Atlas, Magnum, Wearite.
- 2 Sets of Atlas plug-in short-wave coils.
- 2 W.B. 5-pin valve holders, small type, or Benjamin, Lissen, Telsen.
- 1 Telsen short-wave H.F. choke, type W.221, or Bulgin.
- 1 Erie 50,000-ohm potentiometer, or Varley, Bulgin.
- 1 Lissen output choke, type L.N.5300, or Varley, Bulgin, R.I.
- 1 T.C.C. 2-mfd. fixed condenser, type 50, or Dubilier, Graham Farish, Ferranti, Telsen.
- 1 Dubilier 1-mfd. fixed condenser, type 9200/9201.
- 1 Dubilier ·002-mfd. fixed condenser, type 620, or T.C.C., Graham Farish, Telsen.
- 1 T.C.C. ·0001-mfd. fixed condenser, type 34, or Dubilier, Graham Farish, Telsen.
- 1 Graham Farish 100,000-ohm 1½-watt type Ohmite resistance with horizontal holder.
- 1 Polar ·0001-mfd. preset condenser, or Goltone.
- 1 Lissen ½-meg. grid leak with terminals, or Graham Farish.
- 1 Goltone 2-meg. grid leak with wire ends, or Dubilier, Erie, Varley, Lissen.
- 1 Telsen 3-point push-pull switch, or W.B., Benjamin, Bulgin.
- 8 Goltone indicating terminals, or Belling-Lee, Clix, Bulgin.
- 1 Peto-Scott aluminium panel, 14 in. × 7 in.
- 1 Peto-Scott Metaplex baseboard, 14 in. × 10 in.
- 3 yards Goltone 18-gauge T.C. wire.
- 2 yards Goltone insulating sleeving.
- 4 Clix wander-plugs, or Belling-Lee.
- 2 Clix accumulator spades, or Belling-Lee.

Screws, flex, etc. (Peto-Scott).



The black lines show the wiring, some of which makes direct contact with the metallised side of the baseboard by means of nuts and bolts.

BATTERIES & PHONES

H.T. 120 VOLTS: Ediswan, Siemens, Lissen, Ever Ready, Pertrix, G.E.C., Drydex, Marconiphone, Grosvenor, Hellesens or Block H.T. accumulators.

G.B. 9 VOLTS: Hellesens, Drydex, Siemens, Lissen, Ever Ready, Pertrix, Ediswan, Marconiphone, Grosvenor.

L.T. 2 VOLTS: Block, Lissen, Pertrix, Ediswan, Exide, Oldham, G.E.C.

HEADPHONES: Ericsson.

The three components used for the resistance-capacity coupling are a 100,000-ohm anode resistance, a ·002 fixed-grid condenser and a grid leak of ·5 megohm.

The L.F. valve is provided with choke-filter output—a refinement that always earns its keep in short-wave receivers.

Constructional Considerations.

This exhausts all that I need say about the theoretical circuit of the set. On the constructional side there are a number of small points worthy of attention.

We all know by now the desirability of building a short-wave set either on a metal chassis or on something that is a rough approximation to all-metal construction. At the same time, however, it is a mistake to mount flat components such as the

(Continued on page 144.)

PEN-DET NEW EVERYBODY'S 3
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LISSEN "SKYSCRAPER 3." Chassis model with (Lissen) S.G. Detector and Pentode Valves. Cash Price, **£4/9/6.** Carriage Paid. Balance in **11** monthly payments of **8/3.** Send **8/3** only

NEW LISSEN 7-VALVE SUPER-HET CHASSIS MODEL, complete with Lissen Valves in Sealed Carton. Cash or C.O.D. Carriage Paid, **£8/17/6.** Balance in **11** monthly payments of **16/6.** Send **15/-** only

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38 in. high 22 in. wide 15½ in. deep Speaker Compartment, 17 in. by 19 in. by 14 in.

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Direct from Factory. No MIDDLEMAN'S PROFITS. Built by master-craftsmen of the piano trade. Real inlaid walnut mortised, tenoned. French polished With motor-board ready to take your set, speaker and power equipment. Plain front or vignetted panels, 14 in. by 7 in., 16 in. by 7 in., 18 in. by 8 in. Baffle-board, 3/6 extra.

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NEW BLUE SPOT CLASS B OUTPUT STAGE. As advertised. Complete with Osram B21 Class B Valve. Cash or C.O.D. Carriage Paid, **43/6.** Balance in **11** monthly payments of **4/-.** Send **4/-** only

AVOMINOR NEW UNIVERSAL MODEL Measures 0-6, 0-30, 0-120 M.a., 0-6, 0-120, 0-300 volts, 0-10,000, 0-60,000 and 0-1,200,000 ohms, complete with leads. Cash or C.O.D. Carriage Paid, **£2/0/0.** Balance in **7** monthly payments of **5/6.** Send **5/6** only

PEN-DET

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As for Kit "A," but with Valves and PETO-SCOTT Universal Table Cabinet. Cash or C.O.D. Carriage Paid, **£5/1/3,** or **12** monthly payments of **9/3.**

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S.T. 500

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen Class B Output Choke, Peto-Scott "Metaplex" Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy of "Popular Wireless" Oct. 21st. Cash or C.O.D. Carriage Paid **£5-5-0** *or 12 monthly payments of 9/6*

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1 Pair of Controlling Resistances for above. Cash or C.O.D., **11/6.** Or Television Motor and Pair of Resistances, 5/- Deposit and 8 monthly payments of 5/-.

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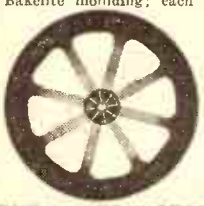

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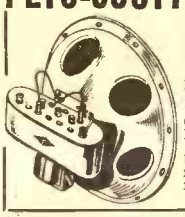

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ADDRESS.....

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SEND DIRECT to AVOID DELAY — CASH, C.O.D. or EASIWAY

THE "PEN-DET."

(*Continued from page* 142.)

aerial-coupling condenser and the grid condenser against a metal base.

To save the extra trouble of mounting such components "up in the air" I used for this receiver a single-sided Metaplex baseboard, with the "business side," so to speak, underneath. Connections from the appropriate points to earth—all the earth-return leads, in fact—were simply taken through by means of bolts and washers. The front panel is of metal, and one therefore has practically all the advantages of chassis construction without the extra amount of drilling and assembling that is usually involved.

The Secret of Success.

Results certainly justify the provision of an earthed base to the set; stability leaves nothing to be desired, and at two or three different locations at which the set has been tried out it has been found impossible to produce any suspicion of hand-capacity effects.

Note, too, the layout. The back-of-panel diagram does not show as well as the photographs the clear space that has been left between the panel and the more important components. The whole secret of success in short-wave receivers, from the layout point of view, lies in effecting the best possible compromise between long leads and cramping of parts.

The leads from the coils, for instance, to the condensers on the panel are certainly longer than they need be; but it is questionable whether one would gain anything in efficiency by putting the coils close up against the metal panel.

A Common-sense Layout.

Common sense gets very near to bringing us down to a standard layout for small short-wave sets; in fact, after we have allowed for the shape and size of such components as the coils, I find that I generally finish up with something very much like the arrangement used in this set.

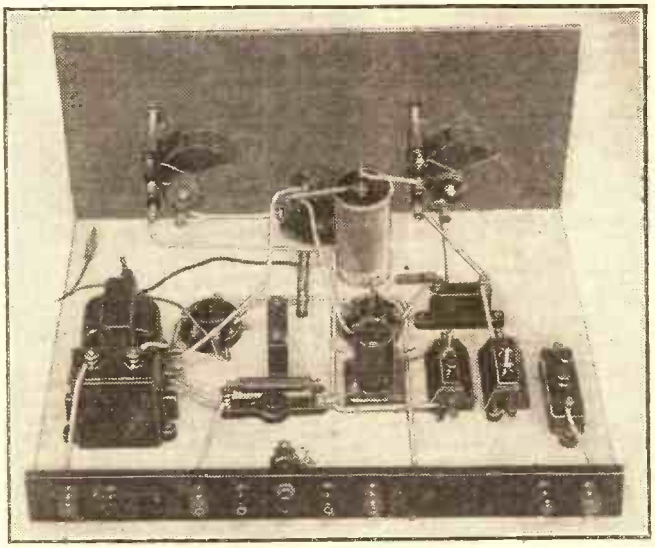
It may be responsible for a certain uniformity in the various sets that I make, but, after all, it is better to have uniformity with a fair degree of efficiency every time than to have endless variety both in appearance and results!

There is no need for me to expound upon the necessity for careful checking over of the wiring when the set has been completed. It is as well, however, to use some simple form of tester to make sure that all the earth-return leads have really "gone home."

(*Continued on page* 150.)

WHICH VALVES TO USE

Make.	Detector.	Output.
Cossor	220H.P.T.	220P.A.
Mullard	P.M.22A	P.M.2A
Marconi	P.T.2	L.P.2
Osram	P.T.2	L.P.2
Mazda	220Pen	P.220
Dario	T.C.432	T.B.122
Hivac	Y.220	P.220
Tungsram	P.P.220	—



NO HAND CAPACITY WHATEVER.
The old bugbear of hand capacity when tuning is entirely absent from the "Pen-Det." which uses a Metaplex baseboard (or else foil covering the underside of the wood) and a metal panel.

THE LISTENER'S NOTEBOOK

What do YOU think of the recent programmes? Our contributor, who is a keen and regular listener, makes some critical comments this week on the way in which the broadcast fare is being presented by the various B.B.C. departments.

I LIKED the idea behind "Entertainment Hour" more than the Hour itself. I prefer to think of it as several groups of songs being linked up by an odd variety turn or two. Tessa Deane and Frank Drew were the "big noises" of the Hour, with Tessa Deane the bigger noise of the two!

Her singing was superb. Frank Drew didn't always make it clear what he was singing about. The *pièce de résistance* of these vocal duets was, I thought, the numbers from "The Vagabond King." "Only a Rose" is the sort of tune that haunts one for days.

* * *

Florence Desmond was disappointing. And I had been so looking forward to her return to the mike! I suppose her turn is as clever as ever, but the success of her line of business depends on our knowing the people she is impersonating. Yes, I *do* know Mae West, and I think Miss Desmond hits her off to a "t." But Zasu Pitts! To ignorant me she might be anybody. Anyhow, I don't like her voice or what she says. I would like Florence better if she turned her attention to the folk at home.

* * *

Horace Kenney has backed a loser in his Channel-swimming sketch. Horace is a better fireman than a swimmer, but he couldn't go on for ever being a fireman.

The sketch starts well, and we think we are in for some real good fun. But, alas! a depression sets in which nothing can check. The thing peters out with the feeblest finish ever put to anything.

* * *

Stanelli made me want to see him. His motor-horn turn belongs to the same category as the ventriloquist's. Really, the microphone is no place for either of them. Stanelli's patter, however, justifies the turn.

* * *

Yes, James Agate at 9.20 p.m. is all right. James Agate is all right at any time, but at 9.20 p.m. he is best of all. Well, he initiated the new series with a memorable talk, inspired by three young ladies and a man, on Mr. Charles Laughton and Shakespeare.

I was very interested in the queries raised by the three young ladies, for I've been prompted to ask some of the very questions myself. I was just as interested in the answers Mr. Agate gave. I was also satisfied with them and persuaded that Mr. Agate was right.

* * *

How many other listeners would be interested in this particular talk? We listeners are terribly interested in the theatre. Some of us, in fact, are disturbed by the thought that the existence of stage drama is being threatened to-day. Some of us are doing our level best to help it through these difficult days, either by giving it our patronage or by participating in it in an amateur capacity.

Many of us are doing both. But we need help. Mr. Agate, helpful as he is, doesn't always give us, or hasn't always given us, the sort of help we want.

* * *

The B.B.C. doesn't really cater for the amateur dramatic societies. And it should! Don't anyone remind me, please, of those West Regional talks a few months ago! I know all about that! I didn't listen to them because I couldn't get them. They should have been given on the National. Their urgency demands it.

* * *

The death of Sir Gerald du Maurier last week will come as a big shock to listeners as well as to theatregoers. True, Sir Gerald was not heard from the studio nearly as often as one would have liked, but on those occasions when his voice was heard he proved himself one of the finest elocutionists in the country.

Sir Gerald worked zealously for the Actors' Orphanage Fund, and more than one charity has cause to thank him for his successful wireless appeals.

* * *

Wasn't it rather curious that technical difficulties should arise and prevent the first of the new talks on foreign affairs? There is certain to be more than the normal amount of criticism to these talks, once they get under way, if only because of our affection for Mr. Vernon Bartlett.

Mr. Bartlett must have had a quiet laugh all to himself over those failing landlines. But he isn't that sort of man, perhaps! I am sorry for Mr. C. F. Whittall, who was to have given the talk. It was an unpropitious start, to say the least of it!

* * *

A new speaker to me whom I shall be glad to hear again is Mr. Bensusan. I only caught the tail-end of his talk, but he struck me as being an extraordinarily fine speaker. The fact that he could talk on as dry a subject as the drought and county councils, and yet be both humorous and terribly condemnatory, stamps him as a speaker of the rarer type. The way, too, he concluded his talk was, I should say, the best ever yet done over the air.

* * *

That is, if we exclude from our reckoning Capt. David Bone, whose new series of talks, called "Water Front and Open Sea," hold pride of place now at 9.20 of a Saturday evening. It is extraordinary how consistently successful the B.B.C. is in filling this particular space. I make no apology for assuming already the success of these new talks.

The opening talk would rival the best we have ever had in the past. The sea is always a fascinating topic, but when it is given in such a fascinating way as Capt. Bone gives it, with his attractive Scottish accent, it becomes more than a fascination. I can strongly recommend this new series to all and sundry, and in particular to lovers of poetry. Just study Capt. Bone's prose.

* * *

Isn't it nice to hear Mr. Gerald Heard's voice again? It is one we never tire of.

And Mr. S. P. B. Mais', too! The note of sincerity in his words is as marked as ever, and proves beyond doubt that he has the cause of the unemployed very much at heart.

* * *

It was a special treat to hear Charles Laughton as Macbeth so soon after James Agate's talk on this very subject.

The text of Shakespeare was, of course, drastically cut, but one could not help being thrilled by Laughton's personality, although his actual speaking of the lines was not up to the standard which is usually maintained in these Sunday afternoon broadcasts.

* * *

It was unusual to hear both Troise and his Mandoliers and Fred Hartley's Quintet in a Sunday programme. Some of the tunes they played came very near to the dance-music class.

This is the kind of light music which will stop listeners from "going abroad" for their Sunday fare, and which cannot possibly offend the consciences of the most ardent Sabbatarians.

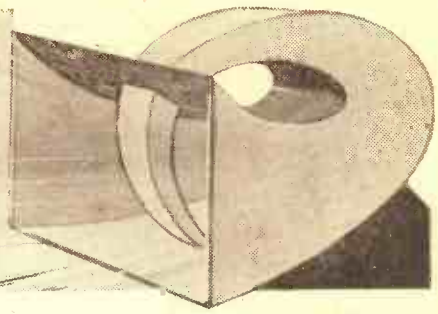
The innovation is one on which the B.B.C. must be highly commended.

* * *

Ashley Sterne and A. A. Thomson provided quite a bright little show in "Table d'Hôte." It was more connected than most revues of this kind. I am sure, however, that the authors would be the first to deprecate the title the "Gilbert and Sullivan of the ether" given them by one newspaper critic!

C.B.

THE SEARCH FOR PERFECTION



ARE developments in the perfection of electrical reproduction of music and speech slowing up? Has finality been reached in the design of the audio-frequency amplifier? Has technical development approached that stage at which further refinement will result in no apparent improvement in the output quality when judged by the human ear?

Do we really want any better quality than present sets are capable of giving? That is the question raised in this contribution, in which quite a new outlook on the matter of reproduction is presented

By JAMES PEERS.

Available Years Ago.

High quality and fidelity in audio-frequency amplifier performance was actually available several years ago—not in radio receivers of low power, admittedly, but in high-power (and high-priced) amplifier equipment such as that used for telephone-repeater work and talking pictures. Many hundreds of cinemas, back in 1927 and 1928, were equipped with amplifiers costing many hundreds of pounds which the designers were confident would keep pace with all possible improvements in microphone and recording technique taking place during the ten years for which they were installed under the terms of the theatre contracts.

A practically equivalent performance in fidelity, if not in output volume, is to-day available in radio receivers and radio-gramophones at possibly a fiftieth of the price of these massively built 15-valve amplifier racks, with their half-ton of auxiliary equipment, converters and batteries.

Such amplifiers would give virtually straight-line amplification from perhaps 30 c.p.s. to 10,000 c.p.s.: from almost the lowest notes of the organ to the valuable harmonics of the high notes of string instruments (on which they depend for tonal beauty).

Undamped Enthusiasm.

But the enthusiasm of the high-quality research laboratories is still undamped, and they are pushing on with the design of microphones, amplifiers, recording and reproducing equipment which will recreate faithfully 12,000, 15,000 or even 20,000 cycles per second.

Such fidelity in these high frequencies will, of course, be of inestimable value in television, when 120- and 180-line images will render faithful transmission of such frequencies essential for true reproduction of the fully detailed image. But is such refinement necessary for audio reproduction? Will our *ears* be grateful for the unremitting toil of the research workers? Or are they gilding the lily, making the mechanism superior to the abilities of the organs with which Nature has provided us?

The human ear, indeed, is surprisingly flexible and adaptable and amazingly tolerant. The number of out-of-date and poorly designed receivers giving reproduction which is but a travesty of what is taking place before the microphone, and the proud satisfaction of the owners of these distorting anachronisms, are adequate evidence of this fact. We have all met the enthusiastic owner of one of those old cylinder record gramophones, for instance, who will stoutly aver that its performance is still superior to the newest radiogramophone!

Wonderful Monstrosities.

This may be an extreme case of acute "non-musical-ear-itis," but there must be literally hundreds of thousands of owners of receivers with such horrors as R.C. valves in the output valve holders and weird and wonderful monstrosities in loud-speakers made from old motor-horns and sea-shells who would be doing themselves, their neighbours and the B.B.C. a favour by scrapping such equipment.

The only really satisfactory way of convincing such devotees of cacophony of the glaring shortcomings of their "machine," as it is invariably called in such households, is by direct comparison with a receiver giving really good reproduction in their own home. They will spend an evening at the house of a friend who has a good receiver and the good name of radio at heart, make guardedly complimentary remarks about its performance, and then return home to switch on gratefully a five-year-old box of junk which sprays into their appreciative ears a mercilessly mutilated medley of "music" from which everything below 300 and above 3,000 cycles has been carefully removed by inefficient components and valves!

A Public Service.

Those energetic radio dealers and radio enthusiasts who take the trouble to give such heretics an opportunity of hearing radio reproduction as it should be alongside such travesties, and converting their owners, are performing a public service.

But at the other extreme there are the super-enthusiasts who have a milliammeter in every plate lead and a loudspeaker with which they can shake the floor and strip the wallpaper from the walls, and who are sighing for fresh worlds to conquer. With anything up to 12 watts undistorted output they can virtually recreate electrically almost everything happening in the studio.

With a few exceptions, commercial instruments have not yet achieved this perfection, and it appears possible that the average standard of performance available need not be improved upon, because the public ear would not appreciate any further improvement in quality.

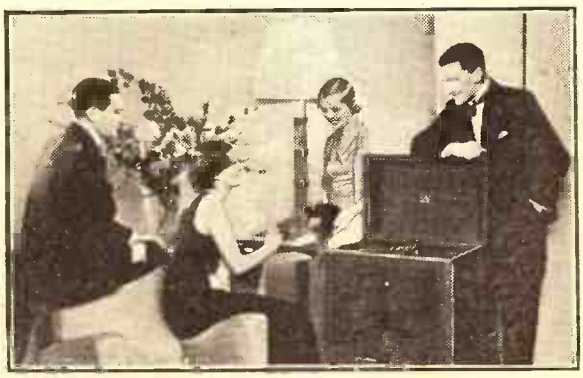
Like the motor-car, the modern radio receiver has apparently achieved for 1934 a sufficiently developed stage of reproductive perfection and fidelity to satisfy average requirements. There will always be a small, exclusive, ultra-appreciative clientele who will demand a 12-watt output, just as there is a restricted demand in cars for 30, 40 and 50 horse-power under the bonnet.

Those Super-Amplifiers.

Similarly, the 8-, 12- and 16-cylinder cars which sell in comparatively small numbers have their parallel in the super-receivers which will be built and sold in the future with a frequency range running up to 15,000 or 20,000 cycles, with little falling off in fidelity.

But it is doubtful whether such 12-watt, 15,000-cycle receiver performances will become general for *aural* purposes. The 2- or 3-watt output receiver, covering about nine octaves of the audio-frequency spectrum, will become the average, general-purpose radio equivalent of the modern, low-power, high-performances automobile, for both provide the entirely satisfactory, economical and dependable performance which the present-day user expects.

DO WE WANT ANYTHING BETTER?



"The modern radio receiver has apparently achieved for 1934 a sufficiently developed stage of reproductive perfection and fidelity," says the author of this article. And he is right, judging from the pleasure expressed by this group of people listening to one of the latest H.M.V. Superhet Radiograms.

TESTED AND FOUND-?

Being Leaves from the Technical Editor's Notebook

NEW ERIE VOLUME CONTROL

VOLUME controls can be the cause of a great deal of trouble. Mostly those that do fail appear to develop insidious faults. A complete breakdown in the resistance element is bad enough, and that is by no means unknown.

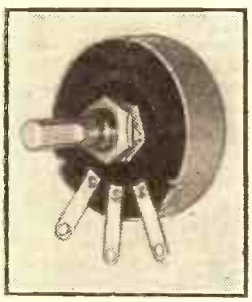
Also a contact that very seldom contacts, so that there are noises all the time, is the sort of thing we thould not have to put up with in these days. But the volume control that apparently works quite well, but which is, in fact, the cause of a mysterious grating that occurs at rare intervals, is indeed a terrible nuisance, for it is often difficult to locate.

Probably the proportion of faulty specimens in volume controls is greater than in any other wireless component, and for that reason I was delighted to learn that Erie Resistor, Ltd., of Waterloo Road, Cricklewood, London, N.W.2, had gone into production with a volume control, for, although there are existing makes that are perfectly reliable, there are not so many that we cannot give a hearty welcome to another.

Very Excellent Components.

The reason why I should so confidently anticipate that Erie Resistor would produce something particularly good in this line is not far to seek. Readers will have noticed that I have spoken very highly on this page of Erie Resistors. They are very excellent components of a most reliable nature.

And it is logical to conclude that makers of such dependable fixed resistances—fixed resistances which have earned the esteem of constructors throughout the world during their many years on the market—would not at this juncture introduce a variable type unless it were something good.



Erie fixed resistances have given such excellent service in the past that home constructors will welcome the new volume control which this firm is now manufacturing.

Curiously enough, the very day after the arrival of samples of this new Erie volume control the potentiometer on our standard amplifier packed up I had one of the Eries put in in its place, and it was at once evident that it was an efficient component, for, despite the purposely rough and continuous handling given to it by one of the mechanics over a period of some days, it maintained a completely silent and effective control.

Delightfully Smooth Movement.

It is a neat, substantially constructed device, and its movement is delightfully smooth.

I have no hesitation in recommending it to the attention of all constructors who are looking for a dependable volume control. It is available in resistances of 25,000, 50,000, 100,000, 250,000 and 500,000 ohms.

DUBILIER ELECTROLYTIC CONDENSERS

Two new electrolytics have been added to the impressive range of condensers made by Messrs. Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, W.3.

The one, type 402, is a neat little chassis-mounting model. No larger than some anode resistances, it is designed for a 12-volt working pressure and has a capacity of 50 mfds.

It is mounted on a metal chassis by means of only the one screw, but the fixing is above criticism owing to the introduction of a patent washer which grips its associated surfaces with an immovable grip.

The negative connection is via the chassis to the metal case of the component; the positive is made by a flexible lead that comes away from the top of the condenser.

Strong Appeal to Constructors.

The other new Dubilier electrolytic is the type 3,003, which is an inexpensive but perfectly reliable model that will appeal strongly to the constructor.

The two types of Dubilier condenser described this week, and recommended to constructors after tests by our Technical Editor. The construction is shown in this photograph.

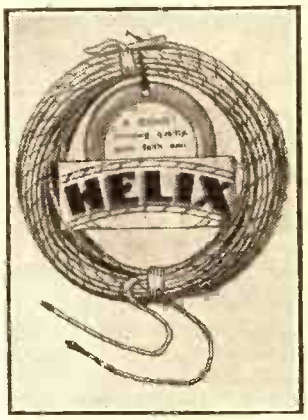
It is built into a tube of bakelised material, and the connections are made to it by means of two wires. This one, too, has a capacity of 50 mfds., but its maximum D.C. working voltage is 50 volts.

It is, of course, of the dry type, and can be placed in any position.

We have tested both types and found them to be completely satisfactory.

SILVER GHOST HELIX WIRE

This is a new product of Lamplugh Radio, Ltd., of Silver Ghost Works, Coventry. It is an aerial wire which sells at a quite competitive price, i.e. 2s. 6d. for a 50-ft. length.



Helix aerial wire embodies a new anti-interference screen described in detail here.

But it has features not found in ordinary aerial wires. There is first a core of tinned conductors for the aerial itself. These are covered with weather-proof insulating material, and around this is spiralled what is termed "The Helix Rejector Wire." The purpose of this last is to act as an open-mesh screen against interference and static charges.

It has to be taken to earth either direct or through a condenser.

The idea of an open-mesh screen of this nature is a quite sound one, and, in certain circumstances, it can be most effective.

Also, as I was able to prove by test, the presence of the "Helix Rejector" does not affect the reception of medium and long-wave broadcasting stations deleteriously.

Jottings of Interest to Buyers.

By G. T. KELSEY.

THOSE of you who intend to pay a visit to the Ideal Homes Exhibition this year may be glad to know of the existence of a rest lounge—not just an ordinary one, but a real super-effort. Exhibitions are all very well, and it is certainly great fun wandering along miles and miles of avenues and seeing all sorts of new gadgets, but few would deny that it is apt to be a tiring business.

Apparently Marconiphone have realised that fact, too, for it is due solely to their efforts that the particular rest lounge to which I am referring is so very well worth a visit.

Remember that old "Minstrel" show of theirs that toured round the country under the title of "Marconiphone Magic"? It is a show somewhat on these lines—but still further improved—that is being staged by them in one of the rest lounges of Olympia during the run of the present exhibition. And if you take my advice you will certainly make a point of seeing it if you are able to get along to the show.

The "Marconiphone Mississippi Minstrels" do their 'stuff' in the rest lounge on the second floor of the Empire Hall, and you have no need to worry about finding the place over-crowded. The lounge in question provides comfortable seating accommodation for over 500 people, and although the show is proving extremely popular I understand that, on account of the large seating capacity, it is usually possible to get a seat.

Old Soldiers Never Die!

A passing tribute to the lasting performance and efficiency of Ferranti transformers. 'Way back in the good old days of 1925 (almost a lifetime reckoned in terms of radio progress!) Ferranti produced a very fine L.F. transformer, which no doubt many of you will remember. I refer to the A.F.4.

Several years after this model was first placed on the market it was partially withdrawn, and no literature regarding it was issued. But the discriminating constructor could not be so easily put off, and, despite the fact that the A.F.4 had been partially withdrawn, the demand for it continued; in fact, it actually showed signs of increasing!

As a result, of course, Ferranti's had no option but to continue to list it, and to-day it is as popular as ever it was. To be quite honest, I cannot say that I am very surprised, for, from my own knowledge of the merits of this particular transformer, I am forced to the conclusion that even now there are few transformers that would come up to it in performance.

One of its great features is freedom from breakdown under tropical conditions—an aspect that should be of interest to all our overseas readers.

For Deaf Listeners.

A week or so ago, in these notes, I drew attention to the fact that H.M.V. were now supplying receivers specially adapted to the requirements of deaf listeners, and since then I have had several letters from readers seeking information as to where the special headphones can be obtained.

I am glad to be able to pass on the news that these special phones are being manufactured by the National Radio Service Company, under licence from S. G. Brown. They can be wound to match the output of any radio receiver or radio-gramophone, and full details and prices can be obtained from the above company at 15–16, Alfred Place, Tottenham Court Road, London, W.C.1.

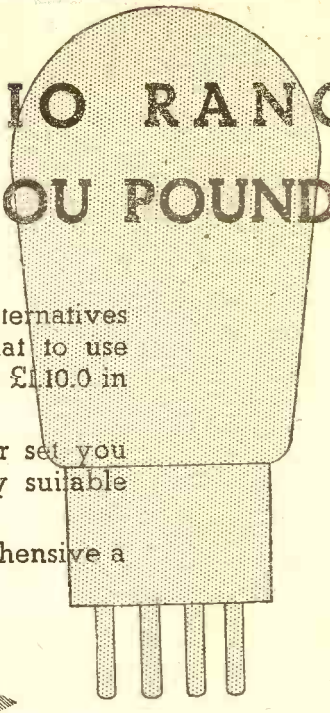
For the Summer Months.

With this very fickle climate of ours, I suppose I shall be taking chances if I dwell for long on the question of out-of-doors radio ideas for the hot (?) months that are in store. All the same, I always was an optimist, and in

(*Continued on page* 150.)

39 TYPES IN THE DARIO RANGE

GOOD VALVES THAT SAVE YOU POUNDS!



Get our list and study the table which shows the DARIO alternatives for all popular valves. Note the prices and you will see that to use DARIO means a worth-while saving of money—something like £1 10.0 in the case of a mains 5-valver.

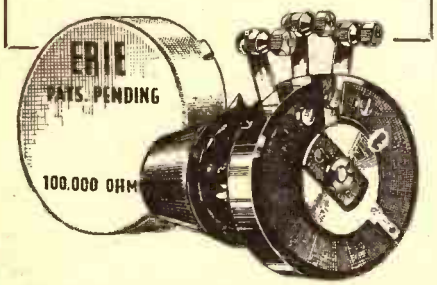
More than that, the DARIO range is so complete that whatever set you have or contemplate, there's a highly efficient DARIO exactly suitable for every valve-holder.

Few low-priced valves can show you anything like so comprehensive a range and no valve at any price can give you more up-to-date design or more consistently accurate manufacture than DARIO!

DARIO VALVES

IMPEX ELECTRICAL LTD., 47, VICTORIA STREET, WESTMINSTER, LONDON, S.W.1

Now ERIE QUALITY IN A **VARIABLE RESISTANCE**



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Specified for the "PEN-DET"

Price **3/6** *Also supplied with built-in mains switch ... ...* **5/-**

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1, Golden Square, Piccadilly Circus, London, W.1

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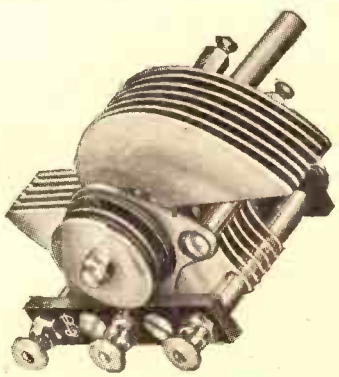
"PEN-DET"

Builders of this new short-wave set should be sure to use specified PRECISION INSTRUMENTS—with no alternative. Make certain you incorporate the 2 J.B. short-wave "special" tuning condensers when constructing your "PEN-DET."



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RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

FITTING A WESTECTOR TO ECONOMISE H.T.

C. E. C. (Stamford, Lincs.).—"I have been a reader of POPULAR WIRELESS for several years, and built several sets taken from that paper which have always given every satisfaction. The set I have now is 'The Sky Hawk,' published in your paper dated Nov. 12th, 1932.

"It has given every satisfaction, and is still going well. Not having too much money to spend on H.T., I would like to know if it is possible to fit such a component as a Westector, or some such device to economise the H.T.

"If you think it would be beneficial to do this will you please give details of wiring, etc., as I am not a very practical engineer?"

It is quite *possible* to fit an economiser unit to almost any L.F. valve set, and arrange it so that the last valve is over-biased during the periods when volume is low, but is automatically enabled to take more current from the H.T. battery when volume rises to the level where this extra current is necessary.

Generally speaking, however, the saving effected by such an arrangement will be large for a powerful set with a "greedy" output valve (i.e. one which takes a lot of H.T.), and comparatively small for the less-powerful set which has only a small power valve.

As the Westector and associated components will cost the same in either case, it will be evident that the economiser will "pay for itself" quickly in the case of the big set, but much less quickly in the case of a small set.

For example, if a set which is hard on a 10-milliamp H.T. battery is fitted with an economiser and would henceforward run well within the battery's capabilities, the outlay on the economiser would soon be repaid. But if the set was one which did not overtax the battery in any way the fitting of an economiser unit would not be justified to the same extent. It would pay for itself in time, but the larger the set the shorter that time would be.

So it all boils down to the question of your H.T. battery running costs, which must be balanced against the first cost of the components required for economising.

These components can be collected separately or in unit form, Graham Farish, Varley, and Benjamin, Ltd., having placed units on the market.

If separate components are used they must be wired as follows: The plate socket of the valve holder in question to one side of a ·25-mfd. fixed condenser (of good quality, to withstand the full H.T. voltage).

The remaining side of this condenser goes to one side of a resistance, the value of which will vary according to the voltage of the bias required. The other side of this to the + terminal of the Westector and to two other resistances, one of 50,000 ohms and one of 250,000 ohms.

The 50,000-ohms resistance is joined at its other end to the − terminal of the Westector and to the lead to G.B. −. (This is plugged into the G.B. battery at about twice the normal negative bias value when the economiser is in use.)

The free end of the 250,000 (decoupling) resistance goes to the secondary of the L.F. transformer (or grid resistance, if that is used instead), and also to one side of a decoupling condenser, which may be of ·1-mfd. capacity.

The remaining side of this decoupling condenser goes to L.T. negative, as usual.

STATION IDENTIFICATION

WARSAW

Until recently the most powerful station in Europe, Warsaw now takes third place on long waves, both Moscow and Luxembourg exceeding the 120 kw. used by Warsaw. The present wavelength is 1,415 metres.

* * *

Either a man or woman announcer may be heard, the name of the station sounding like "Varshova" to English ears. The full announcement is: "Hallo! Polskie Radio Varshova."

* * *

The musical programmes are often of unusually good quality, especially the Saturday evening Philharmonic Orchestral Concerts. Sleigh-bells may sometimes be heard as interval signal in the Warsaw programmes.

CALCULATING THE RESISTANCE REQUIRED FOR AUTOMATIC GRID BIAS.

It does not seem to be generally realised that to find the voltage which is developed across a resistance by a current flowing through it, it is only necessary to multiply the current flowing (amps.) by the number of ohms in the resistance in question.

This is merely an application of Ohm's Law, which in one of its forms states $V = R \times I$, where V is the voltage, R the resistance in ohms and I the current in amps.

A common stumbling block in working out such expressions is the fact that the current in the cathode circuit is generally measured in milliamps, not amps.; but as milliamps are thousandths of an amp., all that is necessary to convert them to amps. is to divide them by 1,000.

Thus 1,000 milliamps = 1 amp.; 100 milliamps = ·1 amp.; 10 milliamps = ·01 amp.; and 1 milliamp. = ·001 amp.

To take an example: Suppose that a current of 10 milliamps will flow in the cathode circuit of a valve, which requires 6-volts grid bias when used with its correct H.T.

Here we have two terms of the expression, and we have to find the third. The two terms which we know are V and I, the V being 6 and the I being ·01.

As we already know V, the form of Ohm's Law which we quoted above is not the one we require; but one of the other two forms in it can be stated as $R = \frac{V}{I}$. In other words we can find the resistance by dividing the voltage by the current.

So we divide 6 by ·01, the answer being 600. This is the number of ohms required in this particular instance to produce 6 volts.

From the foregoing it will be clear that in any set using an automatic grid-bias resistance the grid-bias voltage which this produces will depend upon the current passing through it; so if a different valve is plugged in, and it happens to have a current or grid bias different from its predecessor, the automatic bias resistance will have to be changed to suit the new conditions.

Here is a typical case from a reader who built the "National Eckersley Three." (The particulars are extracted from a letter written by Mr. T. Nash, of 311, Lovely Lane, Warrington, Lancs.)

"I have built the 'National Eckersley Three,' and am at present using a five-year-old pentode valve in the output stage. I wish to replace this with a Mazda Pen.220A, which is the more powerful of the two pentode valves.

"Now, what I want to know is whether I shall have to use grid bias with this valve, and if so what alterations will have to be made?

"I cannot close without saying that it's a most wonderful set. I have built about a dozen, and it is the best of the lot for station getting and selectivity, even with an old output valve."

In this particular instance the 300-ohm resistance which did duty for the old pentode had to be replaced by a 400-ohm resistance, no other alteration being necessary.

Crackles are often caused by straggling leads.

FOR BETTER RADIO

Take care that your terminals and connectors are sound, and that there are no straggling "whiskers" on the flex leads, especially in connection with mains apparatus.

* * *

Never alter the connections to a mains set when the mains are "on." And keep the set where there is no possibility of "live" parts being touched accidentally.

* * *

When the set is to be unused for long periods—holidays, etc.—it is a good plan to take the plug right out of the mains socket for safety's sake. And remember that flex leads need a periodic overhaul.

A POINT TO WATCH WHEN BUILDING A PORTABLE SET.

We are indebted to a Reading reader of "P.W." for a timely tip contained in a postscript to a letter about portable sets.

He reminds us of a trouble that beset him about this time last year, in connection with a strident howl produced by a portable set which he constructed, and which was not traced by our Technical Query Department until several letters had been exchanged, the fault being a very difficult one to localise.

Not wishing other readers to have a similar difficulty, he says: "Perhaps you could put a word in 'Our Paper' about sets with built-in speakers that are placed close to the tuning condensers.

"If you remember, it was not until you suggested that it might be the vibrations of the condenser vanes that I was able to stop the howl, the method eventually adopted

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from previous page.*)

being to mount the condenser on rubber and wedge a little rubber pad between each adjacent pair of vanes, and a rubber stop."

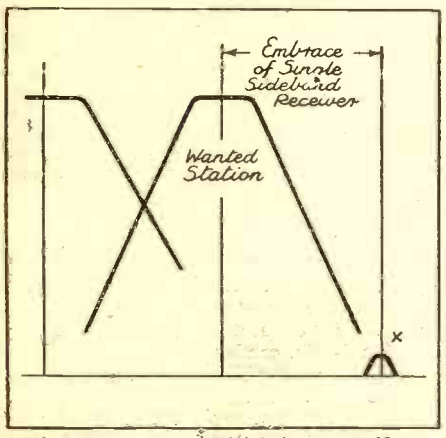
Although this trouble—vibrating condenser vanes—is not a common one, it is worth mentioning, especially in view of the recent interest in microphonic effects.

In this latter connection we have had many more interesting letters.

REDUCING BROADCAST INTERFERENCE.

T. T. W. (Paisley).—"I was unable to understand the reference to a "single-side-band" receiver because I thought that quality depended on a large *number* of "side"

SIDEBAND OVERLAP



Illustrating a case in which interference would be avoided by the use of single-sideband technique.

frequencies being superimposed on a station's carrier-wave frequency. How could a variety of sounds be represented by a *single* frequency, whatever the other good points of the special form of receiver employed ?"

You appear to have misunderstood the reference completely. The whole question has been dealt with in our "Eckersley Explains" columns (see "P.W." Nos. 616, 617 and 618), and the accompanying diagram will make clear the point that has puzzled you.

It shows three carrier-waves (denoted by the upright lines) each accompanied by its sidebands. In the case of the wanted station these are strong, but those of one of the unwanted stations (marked x) are relatively very weak, the others being as strong as those of the wanted station.

Under present conditions each station sends out a *double* band of frequencies, one to the right and one to the left of its carrier-frequency. But the idea of single-sideband transmission is to suppress one of the sets of sidebands altogether, the receiver being able to reproduce such a transmission with quality unaffected.

The advantage, of course, would be the great saving of wavelength space achieved by such a method.

USING THE COILS OF A BAND-PASS UNIT SEPARATELY.

S. H. (Portadown).—"Somehow I never quite liked band-pass hook-ups, and the result is that I have taken my last one adrift to utilise the cabinet for a 2 H.F., det. and L.F. circuit.

"When doing so it struck me that perhaps I could use the two sections of the band-pass coil unit as the coils for the two separately tuned high-frequency stages. It would not only be a saving of L.S.D., which would be very welcome, but the size, etc., lends itself nicely to the arrangement I have in mind.

"Is there any objection to using the two coils in this way, in view of the fact that there is no coupling between them when the condenser which normally separated them both from earth is shorted ?"

It is quite practicable to use the coils in the way you suggest. It will, however, be necessary to mount the unit in such a position that the connecting leads to the two tuning condensers are kept short—a particularly important point where two H.F. stages are concerned.

Provided this is done and the screening is adequate, there is no reason why you should not try the arrangement.

PUTTING THE H.T. ACROSS THE L.T. TERMINALS.

The following rather amusing query is raised in a letter from Mr. G. Lamb, of 1, Birch Avenue, Windlehurst, St. Helens, Lancs.:

"Will you be so good as to settle a friendly argument *re* the fuse as incorporated in your recent 'Airsprite Three' (battery model) ?

"Supposing some misguided blighter put full H.T. (120 v.) *across the L.T. terminals*—what ?

"(1) Would the fuse save the filaments of the valves at the expense of its own ; or

"(2) Would it merely stick its thumbs into its waistcoat (sniff !), with a supercilious 'Serve you right' ?"

We sincerely hope that no "misguided blighter" will try this experiment, for it will give his valves the shock of their lives if he does ! And said lives will be extremely short !

The modern valve does not often "burn out" like the old ones did, or like an electric lamp's filament does, with a fracture of the wire. But excessive voltage applied to it will ruin its electron-emitting properties, though the wire itself is still connecting the two filament pins together.

Such a valve is said to have "lost emission" through the application of the excessive voltage. And although it is possible to doctor certain types of valves and regain a spell of usefulness the valve is really ruined.

To prevent such a catastrophe from being caused by accidental mishandling of the battery leads, the "Airsprite" was provided with a fuse. This is wired in the H.T. negative lead.

So if the H.T.+ lead is accidentally touched on one of the filament wires of this set the fuse which is permanently wired in the negative lead burns out instantly, and so disconnects the filaments from the H.T. battery before irreparable damage is done by the excessive voltage.

If, on the other hand, some "misguided blighter" actually undoes the H.T. battery from its correct terminals and goes to the trouble of connecting it to the L.T. terminals instead—well, he must be asked to pay for some new valves ! No set can stand up to that sort of treatment.

(And it's no good saying that one of those ingenious wander-fuses which we so often recommend would have saved the situation : because if he were as misguided as he seems to be he would not be likely to use the lead with the fuse in it !)

FAULT FINDING

If you are up against a radio problem remember that our Technical Query Department is thoroughly equipped to assist our readers, and offers you its unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require before us in order to solve your problems.

LONDON READERS PLEASE NOTE : Inquiries should **NOT** be made by phone or in person at Fleetway House or Tallis House.

Messrs. Electradix Radios have drawn our attention to their advertisement relating to the No. 11 Solo Microphone in the April 7th issue of this journal.

Will readers please note that the advertised price of 5s. 6d. should not include a transformer ?

A transformer is, of course, included in the No. 11 Table Mike, which is priced at 10s. 6d.

* * *

Messrs. Lectro Linx, Ltd., have asked us to point out that the valve holders referred to in their advertisement in our April 14th issue are known as the *Airsprung*, and not Airspring Type.

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ROLA CLASS 'B' SPEAKER-AMPLIFIER

SENT ON 7 DAYS' TRIAL Complete Class B Amplifying Unit, with Valve and Rola P.M. Moving-coil Speaker. Send only 5/- for 7 days' trial. If approved, balance in 11 monthly payments of 6/6. Cash or C.O.D. Carriage Paid, £3/11/0.

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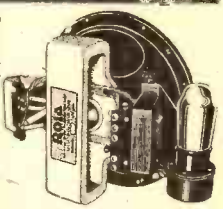

ROLA F.R.6 P.M. Class B Speaker. Send only 5/-, balance in 8 monthly payments of 4/9. Cash or C.O.D. Carriage Paid £1/19/6.

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SENT ON 7 DAYS' TRIAL With Switch Controlled multi-ratio input transformer. Send only 5/- for 7 days' trial. If approved, balance in 8 monthly payments of 5/3. Cash or C.O.D Carriage Paid. £2/2/0. W.B.P.M.6. Send only 2/6. Balance in 8 monthly payments of 4/3. Cash or C.O.D. Carr. Paid £1/12/6.

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Model C.A.25. Suitable for all outputs, including Class B and Q.P.P. Send only 3/6 for 7 days' trial. If approved, balance payable in 11 monthly payments of 5/6 (or cash in 7 days £2/19/6). Carriage Paid.

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When fixing your aerial
—be sure not to shirk—
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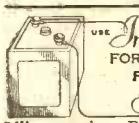
FOR *ALL* REPAIRS!



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P. WALRAVEN,
STATIONSWEG, HILLEGOM, HOLLAND.

THE "PEN-DET."

(*Continued from page* 144.)

Another point which should be examined is the three-point switch. This is necessitated, of course, by the fact that the potentiometer controlling the voltage on the detector priming grid would otherwise be a constant drain upon the H.T. supply. One side of the switch goes to the negative L.T. terminal, one to the negative H.T. terminal and the third to the "earth" side of the baseboard.

There is nothing else in the wiring over which one *could* make a mistake, unless it be the variable condensers, which are also of the three-terminal variety. The type actually used were equipped with a terminal for the fixed plates, one for the moving plates and another connected to the frame. That is to say, both sets of plates were actually insulated from the frame of the condenser.

Earthing the Condenser Frames.

That means that the mere fact of mounting it on a metal panel does not ensure that the earth return is provided for. The moving-plates terminal, therefore, has to be connected to the frame terminal. This is perfectly clear in the wiring diagram.

The best advice I can give anyone who is on the point of switching on the set for the first test is to stop reading at this point—for the present! Insert your valves and coils, connect up the aerial, earth and batteries, switch on, turn the dials and listen! If you have any difficulties come back to the rest of this article a little later. But you can learn more about the set in a quarter of an hour's actual operation all on your own than I could tell you in several thousand words.

The best coils to start with will be a "9" as grid coil and a "6" for reaction. With the full voltage on the priming grid—i.e. with the potentiometer in the "all-in" position—you will probably find reaction control very fierce and "ploppy." Reduce the potentiometer setting to something near the half-way position, and the reaction condenser should control oscillation perfectly. There should be nothing but a faint hiss as you cross the threshold.

Voltage is not Critical.

My own experience with the ordinary 2-volt output pentodes seems to indicate that they are not critical as to priming-grid voltage when used as detectors. Anything between 25 and 50 volts apparently suits them quite well, but it is worth one's while to experiment a little with the particular pentode you happen to be using, as it *may* possibly be fastidious.

The wavelength ranges covered by the various coils should be roughly as follows: 9 turns, 36–65 metres; 6 turns, 25–50 metres; 4 turns, 19–32 metres; 2 turns, 12–20 metres. With the "9" as grid coil a "6" is suitable for reaction. Never attempt to obtain too tight coupling to the aerial. These figures were obtained with the coupling condenser about half in. When the "6" is used as the grid coil it is best to use a "4" for reaction if the set can be made to oscillate all round the dial. There *should* be no difficulty in this, but if it doesn't you will have to use as reaction the "9" or, better, another "6" if you have two sets of coils.

Using the Two-Turn Coil.

The smaller coils each require one size larger for reaction. There may be some difficulty in obtaining smooth and regular oscillation when the 2-turn coil is in use, but it will probably serve its purpose even if the bottom end of the band is "dead," since there is nothing of particular interest below 13·9 metres, and the only station of note in that band is W8XK, Pittsburg, who may be received on other wavelengths.

If the set covers 16–55 metres you may be sure that practically everything you want in the way of short-wave broadcast is there.

There are only two golden rules for operation—always tune slowly and carefully and listen to everything that you hear. I have said this many times before, but here it is again: "The thing that you pass over as a faint squeal *may* prove to be an interesting station when you have tuned it in carefully."

For this reason it is desirable to use a really sensitive pair of headphones. Personally I use a pair of Ericsson which have proved both sensitive and comfortable.

If you use a pentode for the output stage as well, try connecting the phones in series with a 2-mfd. condenser across the "L.S." terminals on the choke, at present unused.

THE LINK BETWEEN

(*Continued from page* 146.)

anticipation of what is to come, here's a suggestion that is well worth noting.

Radio in the garden is an easy proposition. All that is wanted is an extension lead and loudspeaker and 90-odd degrees of ultra-violet. But the playing of gramophone records out-of-doors is not nearly so straightforward unless you are fond of the exercise of walking in and out every time you want to change a record. But what's the matter with a cheap portable gramophone and one of those natty little Belling-Lee Clip-on Pick-up units?

I think it is an excellent idea, and, moreover, of course, its application is not limited to out-of-doors use. With the aid of this unit and practically any old type of portable gramophone, it is the easiest thing in the world to convert your set into a portable gramophone.

The Belling-Lee Clip-on Pick-up unit, complete with volume control and full instructions, costs 35s. "P.W." readers who would care for further details of this unique device can obtain them through the medium of our postcard literature service. **(No. 83)**

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way — just quote the number or numbers.

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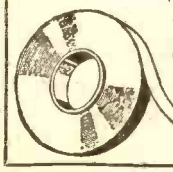

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DOUBLE LENGTH 3/6

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Have You Noticed This?

AN interesting matter raised by a reader this week relates to the heating effect of the valves, rectifiers, etc., inside the cabinet and the influence of this upon the speaker. He found that when the set (a radiogram of a very well-known make) had been running for a couple of hours the loudspeaker began to rattle and the sound grew "fuzzy."

After a good interval—say the next day, when the set was switched on—it would be all right again. On examining it he noticed that it was particularly warm inside. That this warmth was affecting the speaker seems to be pretty well proved by the fact that on leaving the cabinet open for free ventilation, no such effect was noticed with the speaker, no matter how long the set was kept in operation. This is a point to watch with your own set.

Automatic Volume Control.

I have said that Class B is regarded by some people as the most important recent improvement, but, on the other hand, there are many who think that the place of honour should be given to automatic volume control. One of the greatest difficulties in long-distance reception is fading, and, as you know, if you adjust the set so as to compensate for this, then you get distortion, due to the valves being overloaded, when a nearby or powerful station is tuned in. Automatic volume control takes care of all this by keeping a nearly constant output volume, notwithstanding great variations in the input signal energy.

Developments in Valve Technique.

The development of A.V.C. has brought into being various special types of valves, such as double diodes, double-diode triodes and short-base variable-mu valves. The double diode and double-diode triode will act as detector and automatic volume control as well, whilst the second one will function not only in this way, but also as a low-frequency amplifier.

The short-base variable-mu valve is a very interesting one, since it gives much better A.V.C. action than we get with an ordinary variable-mu valve. This is owing to the fact that the amplification can be varied between the extreme limits of the valve by small variations of grid-bias voltage.

Radio Cabinet Changes.

Talking about changes and improvements in radio sets during the past year or two, there has not been very much change in the external form or appearance of the sets, notwithstanding the very great improvements which have been made in their "internals." It has been rather a general practice to arrange the speaker above the controls of the set, but this often means that a good deal of space is wasted inside the cabinet.

Some manufacturers are now getting over this by putting the loudspeaker alongside the "works" of the set instead of on top, which has the effect of increasing the horizontal dimensions of the cabinet and reducing the vertical dimensions. This does not please some people from the artistic point of view, but it has the practical advantage of saving space.

That A.C. Hum.

You may remember I said something in these Notes the other day about A.C. mains hum, and a number of readers have sent me accounts of their experiences in this direction. I have not the space to deal with all the points raised, but one rather interesting point, I think, is worth referring to. It is in a letter from a reader in Nottingham.

He uses a small two-valve (det. and 1 L.F.) set, with a home-made H.T. supply unit using a metal rectifier, the unit and set being mounted on the same baseboard. When this layout was tested it gave a pronounced A.C. hum, although the components were generously spaced out and the H.T. part of the set was carefully screened.

The choke and condensers were tested and found to be O.K., but it was then found that there was a pronounced mechanical vibration (sychronous, of course, with the A.C. frequency) which could be easily detected in the baseboard. The mains transformer was causing this mechanical vibration, although practically no hum could be heard direct from the transformer when not secured to the baseboard.

Mechanical Vibrations.

The transformer was then mounted on sponge rubber in such a way that there was no mechanical connection, except through the rubber, between the transformer and the baseboard, and this had the effect of curing the hum in the loudspeaker, although it could still be detected with headphones. The detector valve was already mounted in an anti-microphonic holder, but, as an improvement, this holder was itself mounted on sponge rubber, and this had the effect of removing the last trace of the A.C. hum.

I thought this particular case was worth mentioning, because I think people generally assume that A.C. hum is picked up only electrically; there must, however, be many cases in which the hum is first in the form of mechanical vibration which is picked up microphonically by one of the valves, generally the detector. This probably explains why careful screening and spacing of components sometimes fail to cut out the hum.

Remember always, then, that the A.C. hum can reach the set both *electrically* and *mechanically*, and any interference which is caused in the latter way can only be got over by the use of some damping scheme such as that described above.

(*Continued on next page.*)

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TECHNICAL NOTES

(Continued from previous page.)

Rapid Radio Progress.

With radio progressing so rapidly, and with all the improvements and inventions that have been made since the beginning of broadcasting, you would think that there was nothing left to discover. But have you never noticed that, just when people think that discovery must surely be exhausted, that is just the very time when a flood of discoveries and inventions comes along ?

The same thing happened at the beginning of the present century. Science had made such enormous strides during the last twenty or thirty years of the last century that it seemed there was nothing left—or, at any rate, nothing *important* left—to discover, and that we could only hope to make slight improvements upon inventions already made.

When you think of the extraordinary number of inventions of fundamental importance made by Edison—to mention one out of a great number of scientists and engineers of the time—you can well understand people thinking there was little left.

Superhet Popularity.

It would take a long time to discuss even briefly the various changes and improvements in radio sets and components which have taken place during the past year or so. One thing, however, which deserves mention is the way in which the superheterodyne type of receiver has come again into popularity.

Many of you will remember that the superheterodyne caused a great flutter when introduced some years ago by Armstrong (incidentally there was always a lot of dispute as to who *really* invented the superhet), but at that time its advantages were not so pronounced—or perhaps I should say that the conditions were not such as made its advantages of great importance. Moreover, it suffered from the disadvantage of being complicated to operate as compared with other sets of the same period.

Selectivity and Sensitivity.

Since that time reception conditions have changed enormously, and in the same way the superhet of to-day is a totally different proposition from that of seven or eight years ago. I should think it is no exaggeration to say that the superhet has increased in popularity more in proportion than any other type of receiver.

The reason for this is not far to seek. It lies in the very great selectivity and distance-getting qualities of the superheterodyne. As we all know so well, the ether is becoming more and more congested, and we are continually having to consider this question of selectivity, which is becoming ever more and more important.

The Bifocal System of Tuning.

Whilst we must all admit the immense and unique advantages of the superheterodyne, I think that superhet fans are sometimes apt to be rather narrow minded with regard to other types of selective circuits. There is no doubt that the selectivity of "straight" sets has been enormously improved during the past year.

You know there are several schemes for improving selectivity, one of the most notable and promising being the new iron-core coil bifocal-tuning scheme, which gives extraordinarily sharp selectivity. In fact, with the introduction of this system the ordinary three- or four-valve "straight" set can be transformed out of all recognition.

Class B Amplification.

In considering important recent improvements it is impossible to omit the mention of Class B amplification. This, in the opinion of many people, is perhaps the most important recent development—at any rate, from the practical point of view—in broadcasting receiving circuits.

It is interesting to note that Class B amplification "proved itself" in a remarkably short time. As a rule, any new discovery or invention has to go through a more or less prolonged "try-out" process, and invariably snags are found which have gradually to be overcome. But Class B seemed to get there right away. Even the little drawback from which it at first suffered—that is, the fact that it needed rather a larger filament current—has been overcome ; the modern Class B valve consumes a current of only 0·2 amp. or thereabouts.

Some of the valves with this consumption may not, it is true, give an enormous power output, but the output is as much as you ever need under ordinary conditions, and is certainly very much greater than that with which we used to be quite content not so very long ago.

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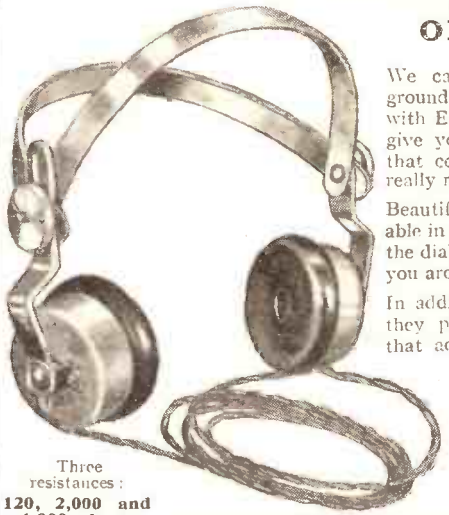

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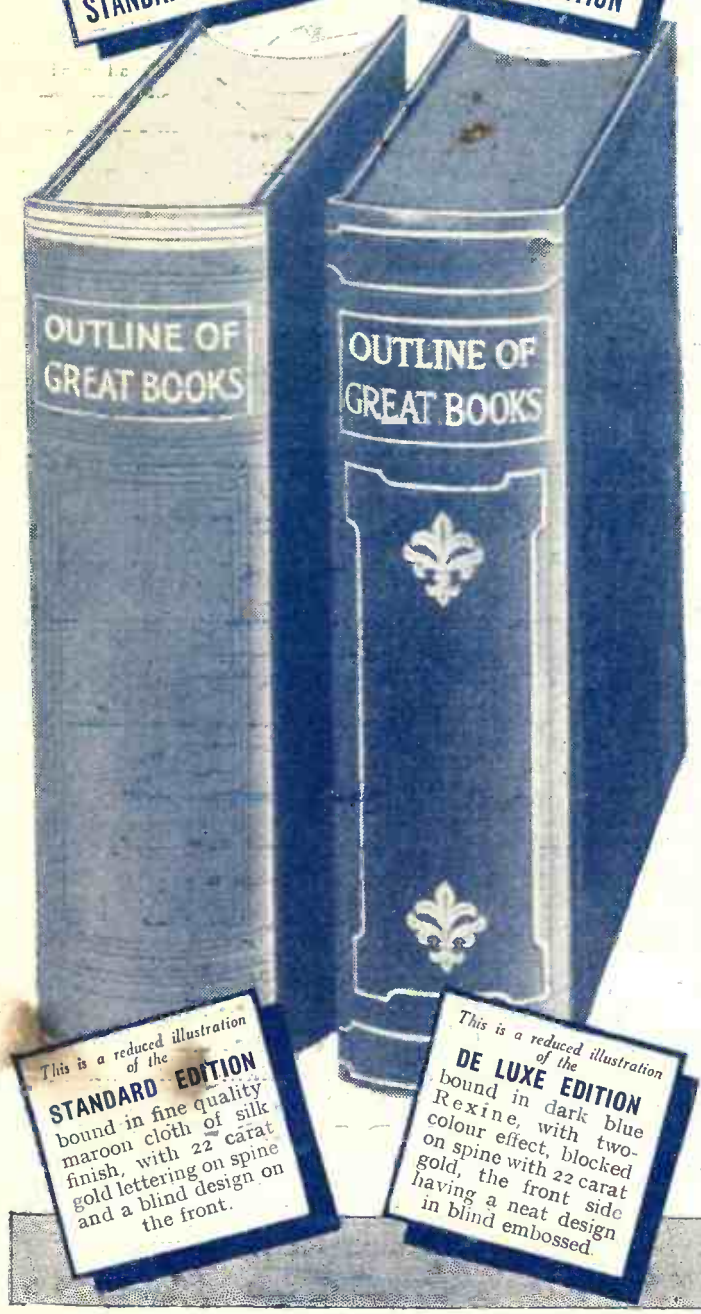

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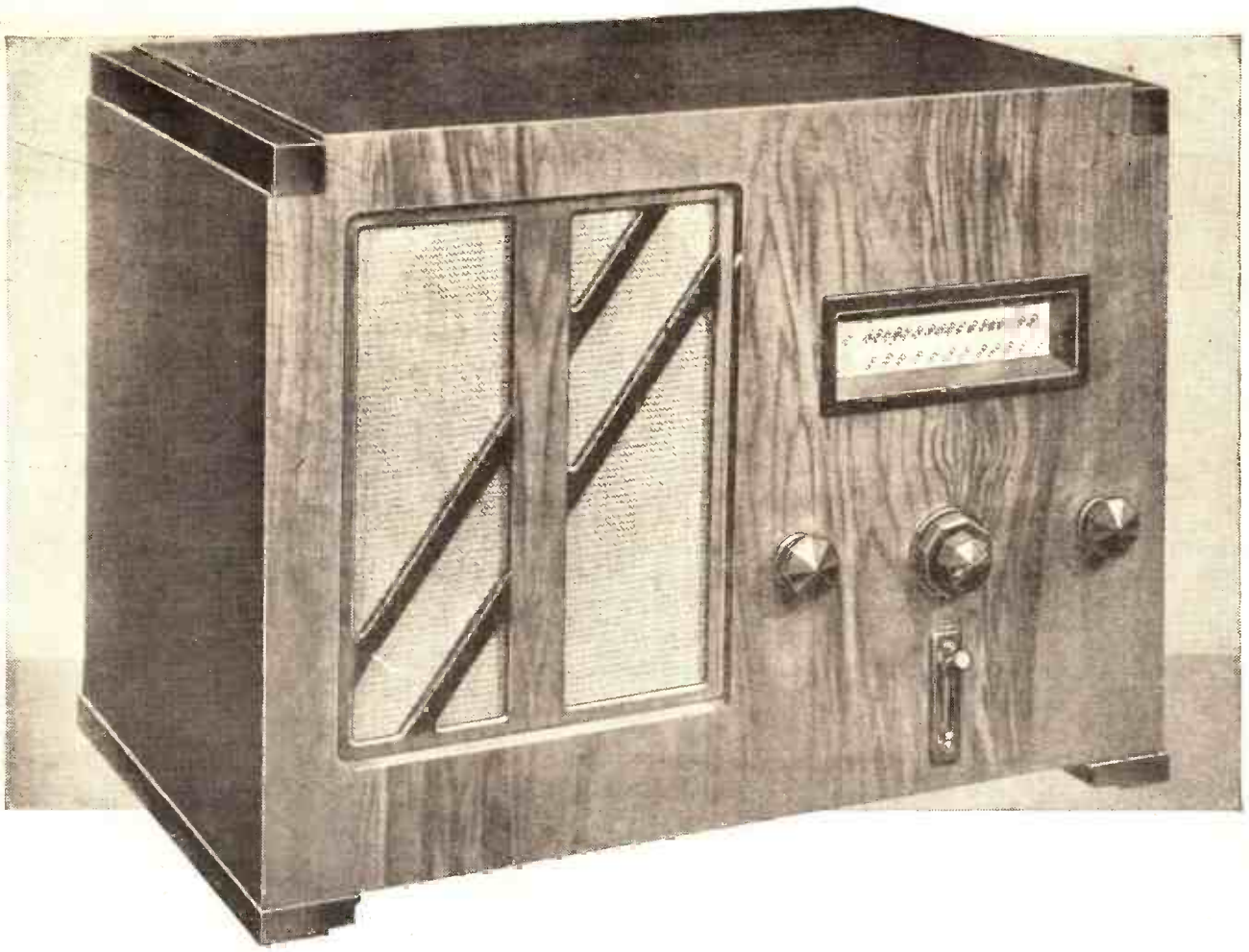

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One Touch of Nature, etc.

PRIDE of place and also my deepest sympathy are awarded this week to a certain sub-postmaster at Yarmouth who failed to obtain a licence for his radio set and was fined. With the cries of thousands of scuttled "pirates" ringing in his official ears he forgot the little formality which sets a man back 10s., but gives him the freedom of "Wozzeck."

When, in perfect good faith, I forgot to renew my dog licence and the law frowned heavily upon my crime-blackened life, I realised that our first happy thought when we wake ought to be: "What lovely taxes can I pay to-day?"

Byrd Awarded Columbia Medal.

THE Columbia Broadcasting people's annual medal for "distinguished contribution to radio" has been awarded this year to Rear-Admiral Richard E. Byrd.

Other recipients of the medal include Col. Lindbergh, Sir John Reith and the charming Amelia Earheart.

Precisely what distinguishes the admiral's contribution to radio I have not yet heard, though it is common knowledge that his radio staff set up small stations at his base and elsewhere. Still, he is a man whom his people delight to honour, and any medal is good enough provided the inscription is O.K.

Wireless and Radio.

IS it possible that there still exists any doubt that "wireless" and "radio" mean precisely the same thing?

Literally, I suppose that the first simply means without wire and the second nothing in particular. But they are both understood to describe one or other of the processes of transmitting energy through space by means of electro-magnetic waves.

I refer to this subject because of a lecture, entitled "Wireless and its Effects on Modern-day Radio," which I saw announced in a trade paper.

Mysterious Noises at T.H.

DURING the last few weeks I have heard mysterious whirring noises every time I have passed the closely guarded doors of the Research Department at Tallis House—noises that were reminiscent of those far-off days when I used to play with miniature electric motors and clockwork engines.

TELEVISION!
Please turn to page 180 for an important announcement.

As I can never be happy when there is going on around me something of which I wot not, I had to do some gentle sleuthing to solve the mystery of that steady hum emanating from K. D. R.'s sanctum. And when I had duly coaxed and cajoled a little information, what do you think it was? Yes. Television.

Ready Next Week.

NOT of the cathode-ray type, of which I know the research hounds are particularly fond, but of the more understandable (to me, at any rate), honest-to-goodness mechanical type. In other words, tests were in progress with both disc and mirror-screw televiewers of a particularly simple character.

Of these I believe you will learn more next week, when I understand details are to be published as to how you can make one (or both) of these wonderful gadgets yourself.

I wish I were a constructor!

Strictly Business.

THE charging by record manufacturers of a royalty in respect of the use of their records for public performance by cinemas, restaurants, etc., has started another small "war." For the Cinema Exhibitors' Association has arranged for non-ring records to be made and supplied at prices from 1s. 6d. to 3s. each, an enterprise which is said to be backed by a plant capable of pressing a million records a month.

Purchasers of these records must, however, sign an undertaking not to use or trade in records made by the British Phonograph Industry, the agreement being operative for one year.

Reply to a Sceptic.

E. A. W. (Nottingham), one of my howler-hunters, thinks that he has found a prizewinner this time: no less than a story about certain of his employees who, on telephoning to him, have sworn that they have heard music and announcements from radio sources. "Being wireless and electrical minded," says E. A. W., "I am sceptical."

The mind is all right, but the knowledge appears to be a little on the weak side, for the alleged phenomenon is a fairly common

(*Continued on next page.*)

FROM H.M.V. TO B.B.C.

Max Kester, who has been on the staff of H.M.V. for four years, has now returned to radio as a member of the Light Entertainment Department at the B.B.C. His last job for H.M.V. was to devise a recorded skit on the feature "In Town To-Night," which he calls "In Town All Night." This picture shows Max playing his new record.

THEY WOULDN'T MISS THEIR RADIO!

occurrence. Somewhere the telephone wires are picking up the current from the leads of a radio set, possibly by induction. Whatever may be the circumstances in this instance, E. A. W. may rest assured that he may doff his unbelief.

Free Board, Lodging—and Instruction.

THERE is always something new if one will but look. Here, for instance, is a news scrap which makes me smile broader and broader the more I think about it. Some unfortunate inmate of the San Quentin Prison hit upon the idea of securing a free correspondence course in advanced music.

He writes regularly to the leaders of well-known American radio orchestras for answers to sets of musical questions, and he gets his answers, too. So there he is, all stone-walled and nowhere to go, enjoying free and private tuition by the cream of America's music bosses.

The cool cheek! It's funny.

The Wonders of Wireless Wire.

ONE of the firms who make those huge cables which one sees on mighty spools beside holes in the road, having to look round for more business, has developed machinery for the production of fine wires for radio and scientific work.

For example, it can now draw wire down to a diameter of two one-thousandths of an inch, finer than a human hair and weighing only 10 lb. per 15½ miles. Another marvel is the enamel insulation of these wires, five coats of which have a radial thickness of only two ten-thousandths of an inch.

Something for the Library.

CLUB secretaries and others who are interested in building up libraries of radio books may be glad to note that the Department of Scientific and Industrial Research has printed "Magnetic Materials at Radio Frequencies: A Critical Survey of Present Knowledge." (Radio Research Special Report, No. 14.)

This paper deals chiefly with H.F. coils of small size, with cores of specially prepared magnetic materials, which are so widely used in radio. The price of the brochure is sixpence, and the publishers are H.M. Stationery Office.

ON THE AIR NEXT WEEK—1

Horace Kenney (*London Regional, May 2nd*).

Born in Leeds fifty-four years ago of an Irish family. Tried to become a stockbroker, but the theatre had a fatal fascination for him. Took up Charlie Chaplin's part in a revue: Chaplin's salary was 26s. a week; Kenney's 25s. First broadcast in 1929 from the London Coliseum as a surprise item. His Fireman sketch is regularly enjoyed by millions of listeners. Confesses to a great liking for the person who pays him the best salary.

Advance in Submarine Radio.

SO far as its wireless navigation is concerned, a submerged submarine is normally blind and deaf, owing to the difficulty of providing a D.F. aerial system which will not interfere with the normal navigation and which can be used below water.

An enormous advance has been made by Marconi's, who have introduced a new D.F. equipment for submarines which gives results, even at a depth of 35 feet, equal to that obtained aboard merchant ships. A feature of this set is a telescopic frame aerial which can be raised or lowered in 20 seconds.

A New England Custom.

WHEN I ventured to express the opinion that the Chicago radio service men were, in a sense, "taking coals to Newcastle" by trying to make America radio minded I little thought that my view would so soon be confirmed. But in an American paper I see a note to the effect that, on being invited by its instructor to dine with him one Sunday, the entire ninth-grade class of a Cambridge (New England) school accepted—*on condition that there was a radio set in his home.*

The young demons weren't going to miss their ration of "scat" for the sake of a free meal or even out of courtesy!

Let's Collect Announcers' Hats.

OF all the terrible things which have been laid at radio's door, none could be worse than that it has bred a new type of collector. The first specimen has come to light in America, but doubtless the European variety exists.

Folk, meet Mr. Phil Duey, a singer who claims to have "collected" the door knob of the first N.B.C. studio on Broadway, part of a control-room panel from the N.B.C. Fifth Avenue studio and the first ticket sold to a Radio City sightseer.

In imagination I see a B.B.C. announcer flying down the corridors of Broadcasting House, hotly pursued by souvenir hunters who have taken a fancy to his monocle!

It's Born in Them.

HE is one of those wonderful men who possess an infinite capacity for selling things. He goes away for six months and comes back with orders for three bridges and a battleship. Yet he used to be one of my most hopeless assistants years ago, with an infinite capacity for burning out valves.

He came to me last Sunday out of the depths of the largest car in the world, and took tea. He is shockingly rich and important, so I gave him plenty of the old-time stuff for the good of his soul, and he ate from my hand like a real sport.

Returning from a long telephone talk, I found him paralysed with laughter. *He had burnt out all the valves in my set!* "I'm as good as ever!" he gasped. "Never could understand circuits. Why, I only just touched——"

ON THE AIR NEXT WEEK—2

Ina Souez (*West Regional, May 5th*).

Started her singing career in America, her birthplace, before singing in opera in Turin. Came to England in "Turandot," and now prefers England and English audiences to anything else. Has played in many light musical shows for the B.B.C., and specialises in "doubling" for non-musical actresses in singing rôles. Her hobbies are admiring other singers, travelling and riding. Her cooking, which includes the preparation of new sauces for spaghetti, is first class.

He Produces Nothing!

VERILY, the way of an amateur scientist is hard. Having recently equipped a small private laboratory for the investigation of materials used in radio work—and, incidentally, to minister to my incurable passion for chemistry—I found myself hard pressed to explain it all to my curious and faintly sarcastic ladies of the house.

"What are you going to make?" they inquired, as though expecting me to come down each evening with three fretworked pipe racks, a woollen jumper and some embroidery.

When I confessed that most of those coloured liquids would ultimately vanish down the sink, leaving nothing but stinks and a few scraps of information, those charming creatures looked at me as one regards a child at play and went on producing "jumpers." Phew!

This One Was Bomb-Conscious.

MASSA JAKE LONG, negro citizen of North Carolina, was sufficiently radio minded to take a job at Station W B T, his duty being to convey packages between the studio and the transmitter.

One day in February he was carrying a new transmitting valve, wrapped in newspapers, when de debbil of curiosity impelled him to take a peep inside the parcel. One glance assured Jake that he was carrying an aeroplane bomb, and, deeming that such employment was unhealthy for a cullud gennelman, he made one long leap to the nearest pond, wherein he threw the nasty little thing.

Chief Engineer Rosekrans later recovered his "toobe" with a hayrake—a tip for valve makers seeking new advertising sensations.

ARIEL.

INFRA-SONICS

A NEW INVENTION WITH GREAT POSSIBILITIES

MR. G. V. DOWDING'S RESEARCHES AND THEIR RESULTS DESCRIBED BY J. H. T. ROBERTS, D.Sc.

WHEN broadcasting first started, some ten years ago, we all used headphones and crystals. Things have changed so since then that I expect many of you who read this article—the younger generation of radio fans—have never even *seen* a pair of headphones, let alone a crystal set.

It wasn't very long before headphones gave place to loudspeakers, as people soon found that the headphone was very inconvenient and catered for only one listener at a time. It lacked that "communal" character which is such a pleasing feature of broadcast listening.

Loudspeaker Development.

Work then went ahead on loudspeakers, and these soon became a commercial article. It may sound strange to you now to hear anyone talk of a time when the loudspeaker was *not* a commercial article. But I can tell you that it was just about the time broadcasting was starting that I was giving a public lecture at one of the northern universities on "Sound Reproduction," and I had a hard job to get hold of a loudspeaker at all!

Many people had heard tell of such a thing, but—like ghosts—nobody had ever *seen* one. Eventually I got hold of one of those with a vertical trumpet, sliced off in a slanting direction at the mouth (like the pictures of "conic sections" in the mathematics books—not "comic" sections, as the schoolboy said, although that would have described it).

This particular specimen was, I believe, unearthed from the university museum, where it had been exhibited for some time as a scientific curiosity—no doubt regarded as quite useless and merely an example of misplaced ingenuity. I quite forget how it functioned in the lecture, but, as everything passed off all right, I presume it must have given a tolerable account of itself.

Since those days the loudspeaker has become more and more important—not only in radio, but in all manner of other applications of sound reproduction—until to-day it may well be said to form an essential feature of our daily—and nightly—life.

It goes without saying that such an important device should receive, and has received, an immense amount of attention from scientists, engineers and others, and the history of broadcasting is also the history of continual improvements and developments in the means and appliances of sound reproduction.

Immense developments have been made in receiving and amplifying circuits and in the various components involved therein, and these have enabled the receiver to deliver to the speaker a more and ever more faithful counterpart of the original subject.

But the "last word" is always with the sound reproducer, which must remain the mouthpiece of the whole affair. It is little use to deliver to the loudspeaker anything which it, in turn, cannot deliver to its audience. And so we have many milestones in loudspeaker development: first the "loudspeaking telephone" with amplifying trumpet; this made things too "trumpety," and soon arrived the "cone diaphragm," which radiated broadly and was a great improvement.

Trumpets were thenceforth a thing of the past, and you were *quite* behind the times if you hadn't a cone speaker. (I confess here to having at least one horn speaker in use still, but that is by the way.) Then we have moving-iron speakers, balanced-armature speakers and various others in succession—each giving at the time "perfect" reproduction—until along came the moving-coil unit: first the electromagnetic and finally the permanent-magnet type. This was undoubtedly a very great step in loudspeaker design, and holds the field to this day. And after all this you would think there was little left to discover about loudspeakers or sound reproduction generally.

This article describes a discovery which has immense potentialities, and which, as the writer says, may revolutionise reproduction both for radio and the talking picture. This discovery has emerged from an exhaustive investigation by Mr. G. V. Dowding, the well-known Technical Editor of "P.W." Dr. J. H. Roberts, who here describes it, has had, as our readers know, an immense experience of Sound Engineering. A further article on this amazing new system will follow next week.

THE MAN BEHIND RADIO REALISM

Mr. G. V. Dowding, Technical Editor of "Popular Wireless," whose research work on sound technique led to the invention of Infra-Sonics.

But before sitting back and congratulating ourselves that everything is now done, just let us make a little experiment. Let us, for instance, go to the spare room and take out that three-valve set of seven years ago, with loudspeaker of same date, all complete—you know, the very one we used to display to our friends with such pride—the one that gave uncanny reproduction—"brought the orchestra right into the room," and all that.

A Lesson in Progress.

Let us just connect it up and compare it with the latest set, and it won't be many seconds before we are roaring with laughter at the idea that we ever thought *that* was music.

It teaches us a lesson, and the lesson is that progress still goes on, and that in another two or three years, or maybe less, we shall be thinking the same sort of thing of present-day performances.

So, you see, in saying that to-day's reproduction is open to criticism we do not mean that we are not conscious of the wonderful advances that have been made; on the contrary, it

(*Continued on next page.*)

INFRA-SONICS

(*Continued from previous page.*)

means that, if so much has been accomplished, how much more is there yet *to be* accomplished!

Let us make it clear, then, that anything said against present-day reproduction is not said in any spirit of carping criticism, but in that broader sense, looking forward to still greater realism in the future.

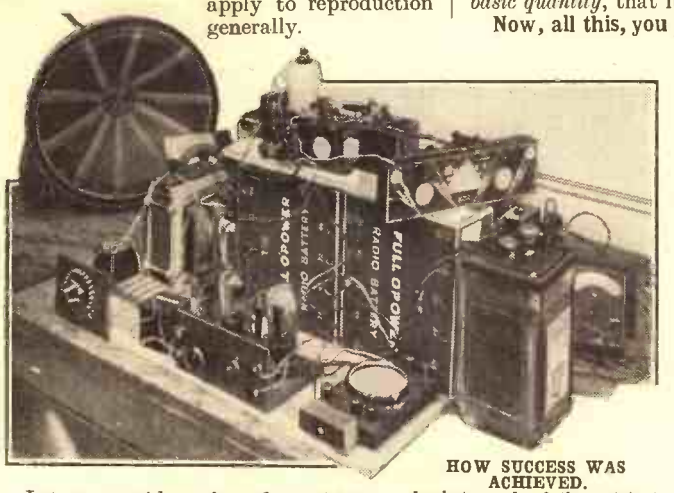
And now for what we have to say about the future possibilities and what Mr. Dowding has been about—as you see from the heading of this article.

You Can "Feel" the Music!

Musicians tell us that, notwithstanding the vast progress of the past few years, even the present-day receiver gives but a "thin" rendering of the radio programme.

"It lacks depth," they say, "and seems to peel off from the surface of the diaphragm, instead of swelling up through the whole atmosphere, as it does in a concert-hall or theatre." "You are too conscious of the set itself, and cannot get away from the fact that it is but a mechanical interpreter of distant sounds."

These criticisms must, of course, be taken in the right spirit, and they must not be carried too far. They are directed, not against the results obtainable with a modern set, but rather against the *limitations* which apply to reproduction generally.



HOW SUCCESS WAS ACHIEVED.
A photograph of the original apparatus used. As you will see next week, the later Infra-Sonic amplifiers are much simpler, and are more compact.

Let us consider what these limitations are, and we shall see that the criticisms—I use the word for want of a better—are not unjust.

A cinema organ forms a good example. In the organ are a vast number of pipes, some of them of great size. The air columns in the pipes are capable of vigorous vibration. When the organ is in full blast, think of the immense amount of air that is vibrating; think of the immense "grip" this gets on the atmosphere of the hall, the way it "embraces," as it were, the whole building and the whole audience; even the very seats tremble at some of the deepest pedal notes, those notes like the rumble of distant thunder. You do not merely *hear* the sound: you positively *feel* it.

Loudspeaker Limitations.

Now, suppose you are listening to this, not in the cinema, but at home on the wireless. You have the best of sets and the best of moving-coil speakers. Everything is in apple-pie order, and you get undoubtedly a very good idea of what the organ really sounds like.

But what has become of that "grip," that fundamental, basic, soul-stirring reality? You think it is there, perhaps, but it is there only in your imagination; it is your past experience and subconscious recollection of the real thing that is, in fact, supplying the deficiency.

And how can it be otherwise? For, when you come to think of it, you are asking one small diaphragm to give to the air that same "punch," that grip, that mass of sound that you get from the whole power of the organ.

Now perhaps my readers begin to understand what I mean by the *limitations* of the loudspeaker. They are no fault of the speaker itself, and, in truth, it is amazing that the reproduction from a speaker should be so good as it is.

I never cease to marvel at the way a small diaphragm can reproduce, with such fidelity and at one and the same time, the music of the violin, the piano, the trombone—the whole of an orchestra—with the intricate overtones of the human voice in addition. It is truly amazing what the loudspeaker can do with *quality*. But, alas! it is in *quantity*, and particularly in *basic quantity*, that it fails.

Now, all this, you say, is very interesting, but what are you going to do about it? What is the use of saying that the loudspeaker is a "key hole," a "bottle neck" of sound, that it is a puny imitation of the real thing and that it can never be anything else?

The only alternative is to bring whole regiments of musicians into one's own parlour.

Reality at Last.

Or why not cut it all out and go to the theatre or concert and hear the real thing?

Until recently—very recently, in fact—I should have felt that this article must conclude on that unhappily inconclusive note.

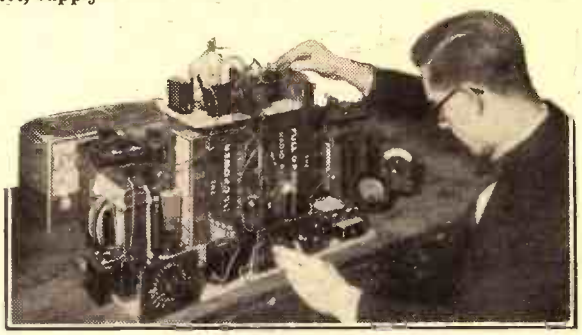
But that was before I had been privileged to hear the results of a remarkable analytical investigation which has been undertaken privately during many months past by Mr. G. V. Dowding, Technical Editor of POPULAR WIRELESS.

Mr. Dowding has been studying from all angles this problem of the limitations of loudspeaker reproduction, and he has at last evolved a most remarkable system which gives what he paradoxically calls "realistic volume without loudness," meaning, of course, "the *effect* of volume without the objectionable character of mere loudness."

To me has fallen the task of outlining to you the general features of this new technique and giving you a glimpse of its extraordinary and far-reaching possibilities.

Mr. Dowding, like all *real* investigators, is far too modest to do justice to his own discovery!

You would understand what extraordinarily fascinating possibilities this opens up if I could now proceed to give you a demonstration of his apparatus. As I cannot do that, I shall have to build up a word-picture of what may truly be termed "the missing link" in sound reproduction, and how it is replaced.



THE FIRST ADJUSTMENTS
A member of the technical staff of "Popular Wireless" matching up the various sections of the experimental Infra-Sonic apparatus.

Ask yourself: What is the fundamental difference between the effect, upon your senses, of the sound of (1) a dance band, an orchestra, a door slammed, a pistol shot, and (2) these same sounds as heard over the radio?

I will supply the answer. You both hear and *feel* the one, but you only *hear* and do not *feel* the other. And without this foundation, this vital *basis* of feeling, the result is bound to be attenuated and artificial.

Test It For Yourself.

Here is a simple way to test the truth of this for yourself. When you hear a sound over the wireless, which you can reproduce for yourself—say the slamming of a door—take the opportunity at once of hearing the real thing, and notice how the first one "leaves you cold" whilst the second one shakes you up.

This sense of feeling, as distinct from hearing, is a vital ingredient, especially in music, and it is largely to provide a more satisfying sensation by an exaggeration of, or addition to, the sense of hearing that musicians are banded together and given robust, "air-punching" instruments in addition to the "thinner" ones which supply the melody.

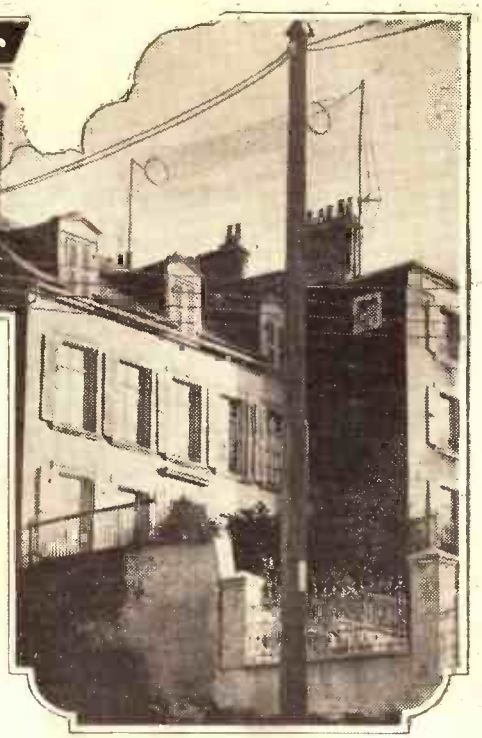
What, for instance, is the function of the bass drum? It gives no music, but it nevertheless provides that fine, basic, robust foundation for the music and adds immensely to the listener's sense of satisfaction.

This sensation of *feeling* accompanying sound may, in some cases, be actually painful; for instance, if someone bangs a big drum or fires off a revolver very close to you, or if a big gun goes off in the neighbourhood, you feel the *air* hit you savagely. (Enterprising radio play producers will rub their hands at the possibility of now being able to give their listeners acoustic buffetings of this nature.) But I am more concerned with the general aspects of this new technique, to which Mr. Dowding has given the name of "Infra-Sonics."

(*Continued on page* 177.)

Destroying Man-Made Static

MAINS INTERFERENCE



By BERNARD BARNARD.

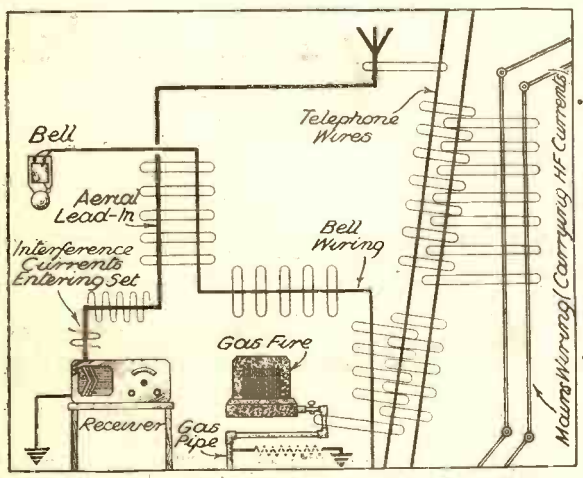
In this, the second article of our special series dealing with the elimination of man-made static, our contributor discusses the routes by which the unwanted interference can reach the receiver.

ANY electrical machinery that, when operating, causes violent surges or fluctuations in current may give rise to interference.

In practice these violent fluctuations are usually found to be due to sparking or irregular contacts such as may take place at the commutator of an electric motor or at the contacts of an ordinary electric-light switch when it is operated.

Switches that "Pop."

Most readers will have noticed the "pop" that is reproduced in the loud-speaker when a house light is switched on. The "pop" is produced by the transmission of a series of damped oscillations generated by the sparking switch; and if you imagine a machine which is generating similar sparks at a high rate due to some faulty or irregular contact, each spark producing its own "pop," you will get a fairly accurate idea of the way in which that only-too-familiar roar of interference is produced.



The next question of importance is the manner in which this interference energy reaches the receiver to produce audible result.

There are two definite paths by which this may take place, and both present their own problems as far as elimination is concerned.

The first and most obvious is "via ether," in much the same way as ordinary radio signals reach us. This, however, is not a very effective path, because the actual H.F. radiation caused by ordinary sparking is very small, and consequently takes effect over very short ranges only.

The other path concerns mains-operated sets only. The violent current changes are effective over a considerable amount of the mains wiring network, and will find their way into the receiving circuit via the mains H.T. supply.

It must be remembered that these fluctuations are not simple changes of voltage of the supply mains, but, in fact, are a superimposed H.F. oscillating current which has been generated by the sparking machinery and carried along the supply wires into your house and into your receiver.

Since the interfering energy is H.F., the ordinary smoothing equipment may not be able to filter it out, and it consequently finds its way to the valve grids, is rectified and becomes an audible signal. And once it is audible you cannot hope to get rid of it in any way.

These two ways in which interference may reach your set, can both obviously be dealt with by suitable precautions.

Unfortunately, this is only the beginning of the story, as you will see by the following: Consider again for a moment the presence of those unwanted interference currents in the house wiring.

HOW ENERGY IS TRANSFERRED

Electrical interference can be picked up by a receiver via any near-by conductor situated between the source of the trouble and the set itself. The sketch shows how the stray H.F. currents in the house wiring may be transferred to the aerial and earth systems through the media of telephone and bell wires, and even gas-pipes.

They are, as we have seen, oscillating currents, and consequently set up a magnetic field around the conductor through which they are flowing.

This magnetic field will, by the simple process of induction, produce similar oscillating currents in any other conductors which may be running near-by, such as telephone wires or bell wiring.

The interfering energy is, therefore, rather like an infectious disease which spreads to all those who come into close contact with the carrying body.

Passing on the Noise.

Just look at the diagram, which shows this "infection" taking place. The aerial lead to the radio receiver is well away from the house wiring, but it picks up interference energy just the same through the media of the telephone wires, bell wires and even the gas-pipes!

You will notice that I have shown the gas-pipes as going to earth via a high resistance; this is usually the case, although, if the pipes run to earth by a good electrical route, they would escape "infection."

This is one illustration of the point which I shall raise very forcibly later on—the importance of using a very good earth!

All this, of course, affects battery and mains-set users equally, and is by far the most serious and efficient means by which interference is received.

Now that we have discovered a little about the nature of interference, I want to give some attention to the all-important question of identifying interference and eliminating the possibility of receiver faults creating the impression that interference is being received.

Crackles Due to Faulty Joints.

Once you have heard real interference there is little chance of your ever mistaking a faulty joint or valve for "man-made static," but it often happens that severe crackling is experienced and is wrongly attributed to radiating electrical plant.

One of the most common characteristics of interference is that it is very much more pronounced on the long-wave band than on medium waves. This cannot be accepted as an axiom, because there are plenty of exceptions. It is, however, fairly safe to assume that if you experience noisy reception and find that the noise is definitely worse on long waves you are picking up interference.

The usual tests applicable to noisy reception, such as tapping the receiver and the valves, will not, of course, yield results in cases of interference, and, normally, a noisy set will continue to be noisy if the aerial is disconnected, whereas the noise will cease if it is due to aerial pick-up.

These simple tests should help you to establish whether your trouble is interference or not.

Wembley Stadium, where Manchester City meets Portsmouth on April 28th.

BROADCASTING THE CUP FINAL

HOW THE WORLD WILL HEAR THE RUNNING COMMENTARY FROM WEMBLEY.

ON the afternoon of Saturday, April 28th, mere man comes into his own. It is the one period of the year when the household radio receiver is commandeered by the head of the family, with the instructions that all who are not interested are to keep away and he is not to be interrupted on any account.

Possibly little Willie and his big brother may be permitted to listen if they keep quiet and do not argue; but for two hours and twenty minutes Saturday afternoon will be a fathers' festival all-over the world.

Millions Will be Listening.

For from 2.30 p.m. (sorry, 14.30 !) on that day until somewhere about 4.50 (16.50) the National programme will take the form of a running commentary of the most popular sporting event of the winter, if not the year—the Football Association Cup Final at Wembley.

At 2.30 sharp the microphones at the Stadium will commence to relay the noises of the 93,000 enthusiasts who have been fortunate enough to get in to see the match. This will be followed by community singing under the leadership of Mr. T. P. Ratcliffe, accompanied by the band of H.M. Welsh Guards.

THE MAN BEHIND THE MIKE

ALLISON, George F. Journalist. Born in County Durham in 1883.

Graduated in Tees-side journalism. Enthusiastic footballer at the outset of his career; played in matches and then dashed off to report them.

Likes to mix with genial personalities. Knows everybody on both sides of the Atlantic. Dislikes intolerant people, grating voices and loud shoes. His lifelong and heart-whole hobby is football. Has been a director of the Arsenal club for many years. Also tries hard to play golf.

Chiefly known to listeners for his thrilling running commentaries on football matches. Makes you jump in your chair, even if you don't know a football from a water melon. **P. C.**

Although there will be 93,000 spectators inside the Stadium, the listening public will number a great many millions, for not only the British Isles, but the Empire and probably the United States of America (via the trans-atlantic telephone), are going to be "hooked up" to the small microphone in the B.B.C. hut overlooking the pitch.

The broadcast will start, as indicated, with crowd noises and community singing, continuing up to approximately 2.50 p.m. while Mr. Derek McCulloch describes the scene. At 2.50 Mr. G. F. Allison will take over and will discourse upon the matter of the day's match, giving the histories of the teams and enlarging upon many points of interest concerning them.

Portsmouth and Manchester City will come out of the dressing-rooms just before three o'clock, and the game will commence on the stroke of that hour.

From then onwards Mr. Allison will be engaged in describing every move of the game until half-time at 3.45. Some ten minutes or thereabouts are usually taken up by the interval while the teams rest (and repair), and the band and community singing divert the crowd.

During this period Mr. Allison will broadcast a summary of the first half of the match for the benefit of those British listeners who have missed part of the first half, and for those listening to the Empire broadcast, which does not take in the first section, but starts at 3.45.

HOW THE TWO TEAMS CAME INTO THE FINAL

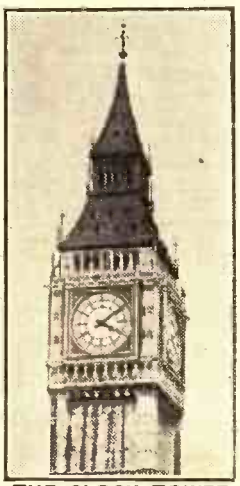
MANCHESTER CITY

3rd Round.—Beat Blackburn Rovers [Home]	3-1
4th Round.—Beat Hull City [Replay]	4-1
5th Round.—Beat Sheffield Wednes. [Replay]	2-0
6th Round.—Beat Stoke City [Home]	1-0
Semi-Final.—Beat Aston Villa	6-1

PORTSMOUTH

3rd Round.—Beat Manchester Utd. [Replay]	4-1
4th Round.—Beat Grimsby Town [Home]	2-0
5th Round.—Beat Swansea Town [Away]	1-0
6th Round.—Beat Bolton Wanderers [Away]	3-0
Semi-Final.—Beat Leicester City	4-1

When the teams reappear the running commentary will continue till the end of the game, after which a short résumé will be broadcast, the relay being timed to conclude at about 4.50 p.m. During the commentary the B.B.C. interpolator, who does the "Square 2" business, will be Mr. McCulloch, who has so officiated at all the relays of the Cup Finals to date.



THE CLOCK TOWER OF WESTMINSTER

APRIL 30th—

BIG BEN TAKES A HOLIDAY

ON April 30th, at midnight, listeners in Britain and the Empire will be hearing the chimes of Westminster and the notes of Big Ben for the last time for some two months.

There have been one or two occasions lately when Big Ben (the clock) has signified, by his refusal to move, that even the most famous of us need a rest sometimes. So he is to be given a real holiday, lasting from six to eight weeks, for complete overhaul.

There was a time when such an announcement would have aroused no more than a passing interest in the minds of non-Londoners; but since the days of broadcasting Big Ben has become a national—almost an international—institution. Things will not be the same for listeners while Big Ben is silent.

But Westminster's loss is the City's gain. Big Ben's holiday will allow St. Paul's to come into its own. During the eight weeks from May 1st the B.B.C. will broadcast the chimes and the hour from St. Paul's Cathedral at all times when Big Ben is now heard.

The actual bell on which the hour will be struck is *not*, as some people think, the great bell of St. Paul's. This great bell is called Great Paul, weighs more than 17 tons (Big Ben weighs 13½) and was erected in 1882. The bell listeners will hear is the striking bell, which is also used in the case of special tolling for deaths. This bell has no official name, but many people—the B.B.C. among them—like to call it Great Tom.

The giving of such a distinguished name to a "mere striking bell" will drive the good people of Oxford and Lincoln into high dudgeon. For Great Tom is the 8-ton bell of Christ Church, Oxford, and Great Tom is the 5-ton bell of Lincoln Cathedral. Great Tom of St. Paul's—pshaw!

But listeners all over the world will rejoice that, during Big Ben's holiday, such a worthy successor will uphold the character of London.

THE CLOCK TOWER OF ST. PAUL'S

TELEVISION MIRROR METHODS—

DRUM *versus* SCREW

by G. P. KENDALL B.Sc.

I SEEM to be spending quite a lot of time lately in explaining the merits of various rivals to the mirror-drum system, and it occurs to me that I may perhaps be making some of the drum users feel unsettled in their minds.

Before I go off on the same tack once again, therefore, let me say a reassuring word on the point. It is this: If you are already using a drum you can rest assured that it is dealing with the present 30-line transmission just about as well as the job can be done.

With disc, mirror-drum, mirror-screw, scophony and cathode-ray systems of television transmission and reception it is difficult for most of us to obtain a clear grasp of the subject. Mr. Kendall, however, has made it his special study, and in this series of television articles is carefully ironing out the problems that obstruct the understanding of radio's most fascinating aspect.

This week, in his usual lucid style, our contributor compares and contrasts the properties of the most popular forms of television scanning—the mirror drum and mirror screw.

So far as this transmission is concerned, there would really be no point in changing over to one of the other devices, even were you inclined to do so. You would not get a better picture, and that, after all, is the only thing that matters.

The real interest of these other systems lies in the fact that they appear to offer some promise of being able to cope with the more finely scanned pictures which we hope we shall get one day. Which of them will succeed in doing so will obviously depend upon the actual fineness of the scanning, and that is a matter which cannot yet even be guessed. All we can do, therefore, is to study all the methods and see that we understand them, against the time when we may want to use one or another.

Rotating Mirror Difficulties.

Before we start on the one I have chosen for this week, let us just remind ourselves of the particular features of the mirror drum upon which we want to improve. The main point is that the drum, as usually designed, is not well adapted to a transmission of very many scanning lines, or a high picture-frequency.

To accommodate the multitude of mirrors required by, say, a picture with 180 scanning lines, the drum has to be made so large that it becomes quite an unwieldy object. Even if its great bulk could be tolerated from the practical point of view it would cause trouble for another reason, which is that it would be extremely difficult to build with such accuracy and perfection of balance as to run with the requisite smoothness. This means in practice that it is well-nigh impossible to run such a drum at the high speed called for by an increase in the picture frequency.

In contrast let us examine the system called the mirror screw. Here the collection of mirrors is no longer placed around the periphery of a drum, but instead it is arranged in the form of a *screw spiral*. In this case it is not necessary for each to be tilted in relation to its neighbours to direct the light spot to the desired point on the screen, the required effect being obtained by the *positioning* of each in the spiral.

In this way it proves possible to achieve a great gain in compactness, and hence in reduced weight. This is a noteworthy advantage, even in a viewer intended for the present type of transmission, for it leads to a definite reduction in cost and a gain in simplicity.

The advantage is sufficiently great to entitle the mirror screw to serious consideration from anyone who is contemplating the construction of a television receiver. Certainly I should choose it myself in preference to the drum, on the score of compactness and low cost.

So much for its attractions from the view point of use on the existing transmissions. Its adaptability to high-definition pictures may be gauged from the fact that it has been used successfully in Germany on a 90-line transmission. That is probably not its actual limit, but I doubt whether it would be found practical for pictures scanned very much more finely than this.

As a matter of fact, the dividing line seems to come somewhere about here for all the mechanical methods of scanning. The ones which particularly lend themselves to multi-line scanning will mostly cope with something like 90 or 100 lines, but to go appreciably higher calls for the invaluable cathode-ray tube unless one is prepared to face very great mechanical difficulties.

Persistence of Vision.

Those difficulties have been faced by certain workers in Germany, using one form or another of the mirror screw, and they have achieved some spectacular results. I hear of experimental scanning speeds of 25 pictures per second, combined with as many as 140 lines per picture, which just shows what perseverance will do!

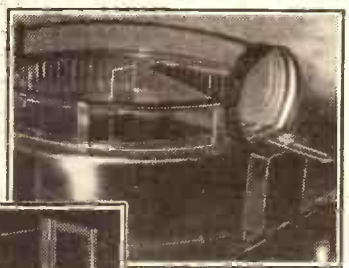
It is noticeable, however, that most of the reports of such work lay enormous stress on the need for the greatest of skill and accuracy in the construction of the apparatus, and don't seem too happy about its power to run for any length of time without adjustment. One rather suspects, therefore, that it should be concluded that such gear is still in what is politely called the "laboratory stage."

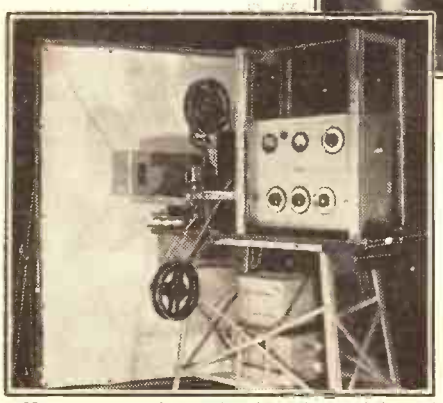
I had intended in this article to explain just how the mirror-screw scanner works, but I find that this will be quite unnecessary. In next week's issue there will be a description of an actual practical design for the construction of a screw-type viewer, and if the reader goes carefully through this he will get a good grasp of the working principle.

Instead, let me use my remaining space to clear up a difficulty, which seems to be troubling several readers, concerning persistence of vision. Their problem is to understand how, if the eye has this lag effect, it can see anything which lasts but an instant, like a flash of lightning.

The answer is to be found in the fact that the lag only affects the *dying away* of the image sensation in the eye: the *perception* of the image, in the first place, is almost instantaneous. Thus, in the case of the lightning flash, the eye sees a streak of light the moment it appears; then by virtue of persistence it goes on seeing it momentarily after the flash has ceased.

HIGH-SPEED MECHANICAL SYSTEMS





Many systems of scanning have been tried in order to obtain high-definition television reception by mechanical methods. The ordinary mirror drum is too unwieldy for 120- or 180-line work, while the mirror screw, too, is a doubtful solution to the problem. In the photographs we see a system developed by Mihaly (top) in which he obtains 180 lines and 25 frames a second with a new mechanical scanner, and below is a Scophony transmitter.

MASTS—OR WATTS?

A DISCUSSION ON THE RELATIVE MERITS OF HIGH AERIALS AND BIG POWER

BY P. P. ECKERSLEY, M.I.E.E.

AND so Budapest has erected a single-mast aerial! I proposed that this should be done six or seven years ago——

* * *

When I was in the B.B.C. I wanted to find out about aerials. T. L. Eckersley and Stuart Ballantine (of America) told me. They seemed, in effect, to say that a high aerial *was* better than a low one—so *much* better that it was worth while using a high aerial in spite of the cost of erecting big masts.

But that was all theory. I wanted to verify theory. This has great advantages: it allows one to do lovely experiments, and when these prove the original theory wrong they provide the theorists with additional exercises for their ingenuity. But T. L. Eckersley and Stuart Ballantine were right.

Kite-Balloon Aerials.

Our experiments involved a kite balloon and long pieces of copper wire. The kite balloon held up different heights of aerial; we energised these aerials and people round and about took field-strength measurements.

These were taken locally—tens of miles away and hundreds of miles away. The theory was proved. The half-wave aerial became a practical ideal. T. L. Eckersley, H. L. Kirke and I published a paper on the subject. Hence the Budapest aerial.

But it is questionable whether the Budapest people have gained anything. The calculation of the efficiency of a station should, in my view, be based upon the cost of establishing a given strength of signal at a given place.

Those paying for the Hungarian station might say to those competing for the contract to erect the station: "See, we wish, for a minimum cost, to establish such and such a field here and such and such a field there." (Where "here" and "there" are is nobody's business except the contractee's.)

Which Costs the Most?

If you had a low, tiny mast and a low, tiny aerial, but tens of thousands of kilowatts, you would get the same strength of signal at a given point as if you had far fewer kilowatts and a far bigger mast and aerial. The question is: Which costs the most money: kilowatts or masts?

I haven't got all the figures at my fingers' ends, but I say it is questionable whether it is a good idea to go the limit either way. The Budapest people have gone the limit in masts, and they have high power. But a little higher power and a little less mast might have established the same field.

It's no good saying that, given a high mast and a higher power, the field could be greater. Of course it could! You can go on like that for ever. Scientifically, it comes to the cost per millivolt of direct ray at so and so many kilometres distance from the station.

* * *

It is interesting to see which costs most: masts or kilowatts. Suppose we say that a 500-foot mast costs £2,000, and that cost increases as height, cubed, we get a 1,000-foot mast for £16,000. Write this off in ten years and you get a cost of £1,600 a year for the single mast.

To get the same field with a 500-foot mast as with a 1,000-foot mast you would have to increase the sending power 1·3 times (about). Assuming the maximum power as 100 kilowatts, the lower-masted station would have to have a power of 130 kilowatts. Assume that the power generated is six times the aerial power, and you have to have 600 kilowatts in one case and 780 in the other.

Assume you work 4,000 hours a year, when in one case you have to pay for 2·4 million units and in the other 3·2 million units, or 800,000 units more for the lower mast. Assume one penny a unit, and the extra power costs amount to more than £3,000 per annum.

But the cost of the masts was only a revenue of about £2,000 per annum at compound interest written off over ten years. And, of course, a twenty-year write-off is feasible.

So Budapest is right so far.

The only question is: Could you get practically the same aerial efficiency by using a single mast, but making it shorter (therefore less expensive), but almost as efficient by taking an umbrella "top hamper"? That is what the B.B.C. do, and I think they are probably right. One would, however, require to do some fairly elaborate calculations to find out the best course to follow.

Power Is More Expensive.

All I want to show is that, in general, watts cost more than high masts (when we are dealing with modern broadcasting stations).

* * *

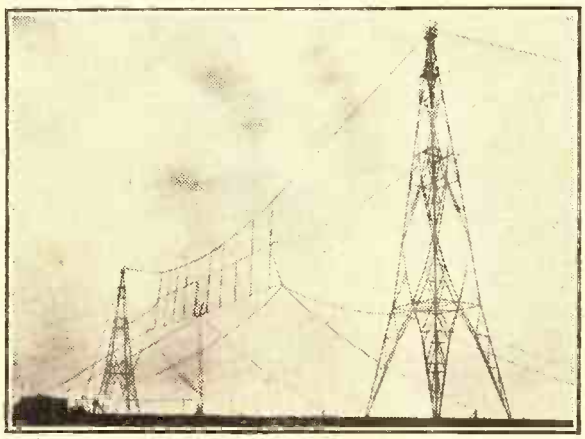
But a modern broadcasting station, designed to be—shall we say?—widely heard, involves fairly high costs. Think of two and three millions of units of electricty consumed in a year! And masts over 1,000 feet high! But money is never stinted when armaments are in question. Private enterprise could hardly face the expenditure involved. And yet there is Radio Luxembourg——

I foresee a greater and greater competition in power. Prague and Budapest have the greatest-powered stations in Europe. If you want to be heard to-day you must shout. Where wide spaces have to be covered high power is the only solution. America and Russia would be justified in using powers up to 10,000 kilowatts to serve properly their own (rural) nationals. (Urban people could get a wire service.)

A Strange Situation.

But it seems strange, when you study Europe, to see Holland (one of the smallest, quite the flattest country in Europe), with the main part of its population concentrated in a radius of 50 miles, using one of the best wavelengths in Europe; to see Hungary and Budapest with the best medium waves, the highest aerials and the largest power; Luxembourg, the smallest of them all, having a station equipped for the greatest penetration; and our own little island embarking upon hundreds of kilowatts at Droitwich.

AN EXCELLENT WAVELENGTH



The wavelength of 1,875 metres, used by the Huizen transmitter of Holland, is considered by P. P. E. to be one of the best wavelengths in Europe. And yet the main part of Holland's population is situated within 50 miles of the station!

OUR RADIO PLAY COMPETITION—

When the winning play will be announced by the judges.

THE POPULAR WIRELESS Radio Play Competition, for which a prize of £50 has been offered in addition to a guarantee of production by the B.B.C. of the winning play, came to an end last month.

The competition has aroused tremendous interest, not only in Britain, but also in many parts of the Empire. During the last fortnight before the closing date every post brought another bundle of entries, so that the task of sorting and classifying the plays for the final judging has been no easy one.

As a result of this preliminary classification no fewer than 70 plays have been sent to the judges for final selection. Every one of these plays will be considered independently by the three judges—who include Mr. Val Gielgud, the B.B.C. Drama Director—so that it will obviously be some time before the final decision is reached.

However, competitors may rest assured that the work of judging is being carried out as quickly as possible, and the name of the winning play, together with other details, will be announced exclusively in POPULAR WIRELESS in the course of a few weeks.

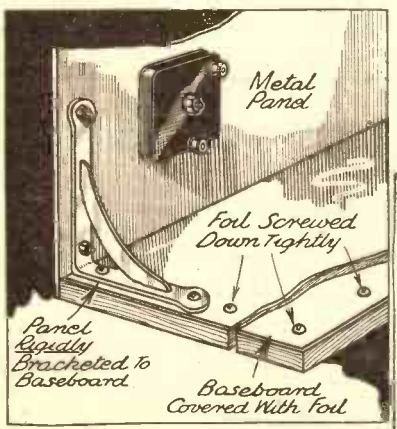
"TAKE care of the pence and the pounds will look after themselves." That wouldn't be at all a bad motto for the short-wave enthusiast, for the little things definitely *do* matter where short waves are concerned.

The people who meet with success are not those who develop beautiful ideas about revolutionary circuit arrangements and wonderful "stunts," but rather those who take scrupulous care about the manner in which they carry their ideas out.

Perhaps I might be pardoned for saying that short-wave set design is a matter of perspiration rather than inspiration. Common sense, good workmanship and an infinite capacity for taking pains are the secrets of success.

Now and then I have an opportunity of seeing readers' sets which come in for test. Five or six years ago, with very few exceptions, they could be classed as monstrosities. Now, however, workmanship has improved beyond all recognition—*but it still hasn't improved enough.*

I think the folk in the Query Department would back me up if I were to say that 90 per cent of the troubles of which these readers complain are due to faulty or unsatisfactory construction.



FIX PANELS FIRMLY

A panel which can move slightly will permit leads to move also, and the total result will be tuning which never seems to "stay put." Always make use of *all* the holes provided in panel brackets for screws and nuts and bolts.

By way of illustrating the kind of things I am thinking of I should like to refer to the picture above. Here we have a typical short-wave set, with a foil covering to the baseboard and a metal panel. Not long ago I saw a set of this type (sent in by a reader with bitter complaints about it), in which no supporting brackets were used for the panel.

To Stop Crackles.

By pushing lightly with one finger it was possible to bend the panel back more than an inch towards the "innards" of the set. This operation caused three or four important wires to bend, and one particular wire had already been forced adrift from its terminal when the set arrived.

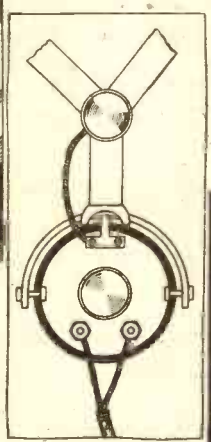
Quite apart from this, the foil was all "crinkly" round the edges, and it had one particular sharp edge that just rubbed against the bottom edge of the front panel.

That particular reader could have saved a considerable amount of postage if he had possessed a little more capacity for taking pains.

SOME LITTLE THINGS THAT MATTER

The amount of attention given to apparently unimportant items can make or mar the results given by your short-wave receiver.

It is absolutely essential to make all these things rigid. If a panel bracket is used, secure it properly by four screws. (I have never been able to understand this craze for economy in screws—they're cheap enough.) Use a few more of them, at frequent intervals, to make the baseboard covering absolutely tight and flat.



The other illustration (right) shows an even more important point. Where you have a vertical screen and a metal panel, do make sure that the two are firmly bonded together. Whether they actually touch or not doesn't matter, but in the name of all that crackles *don't* let them brush gently against each other!

If there is a quarter of an inch gap between them there should still be a good, firm electrical connection between the two. My sketch shows the screen held rigidly up against the panel, because I prefer things that way; but it is just as satisfactory, from most points of view, to have a gap between them, with a wire going across at the top.

A thing that so many radio men do not realise is this: If we have a vertical screen mounted on a metal baseboard, and that metal baseboard is firmly connected to the front (metal) panel, that still won't stop crackles if the *screen* has an intermittent chance of touching the panel.

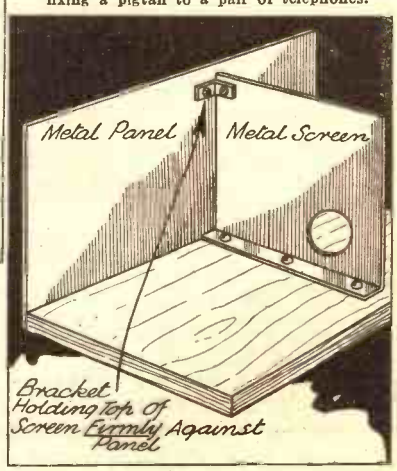
An Interesting Experiment.

Try this experiment some time: Connect your earth lead firmly to the earth terminal, together with another longish piece of flex. Then just rub the free end of this flex along your earth lead at various distances from the set. If the set is oscillating when you perform this test you will be surprised at the noises that can be produced.

The difference between success and failure in a short-waver can often be expressed in one word—crackles!

EARTHING SCREENS

It is advisable to connect the tops of vertical screens to metal panels, even if the screens are earthed elsewhere as well. The centre sketch shows how crackles can sometimes be stopped by fixing a pigtail to a pair of telephones.



My other sketch shows another point that might be worth looking at. Some types of headphones have a kind of "universal joint" which doesn't form quite such a universal *connection.* If you hear crackles when you suddenly turn your head (assuming, of course, that your phone cords are all right) you will probably find them removed if you connect a piece of flex from the actual case of the earpiece to the headband screw, as shown in the diagram.

Other points that are worthy of mention are badly fitting lids on metal boxes, loose, straggly wires of all kinds, masses of loose metal in the vicinity of the set and dirty switches. They all cause crackles!

On the Short Waves—(*Contd. from previous page.*)

WHAT READERS ARE SAYING

"A. H." (Leeds) reports an American station in the 31-metre band signing as W 1 X A E. Does anyone else know anything about this one ?

"C. S." (Southampton) finds conditions quite good lately, particularly for Americans. He wants to get into touch with another red-hot enthusiast in the district. Will such a person please communicate with Mr. C. Stevens, 60, Newcombe Road, Southampton ?

"C. L." (Birkenhead) sends a letter full of news. He has just built a single-valver, and says that it beats all the "twos" (five of them !) that he has used. He, too, finds conditions good for America.

Reaction-Condenser Connections.

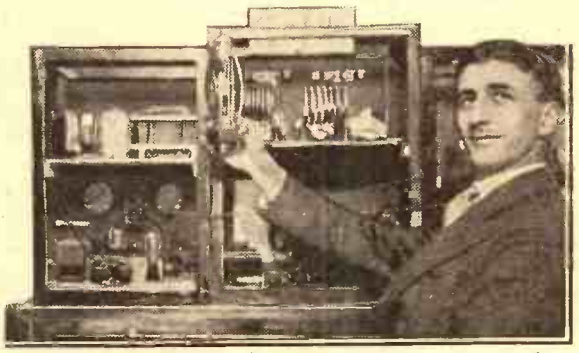
"R. W." (Worksop) asks sundry questions about reaction on short waves, culminating in a private problem of his own. He has taken his reaction condenser directly from the plate of the detector valve to earth, and is worried because reaction decreases as the condenser capacity is increased. But that is surely just what one would expect with that circuit arrangement. However, he finds it satisfactory and also a cure for hand-capacity effects.

He also comments on certain commercial short-wave coils which are wired in such a way that the bottom ends of the reaction and grid windings must be permanently tied together. Personally, "R. W.," I don't like the scheme very much, but, of course, you *can* have the reaction condenser between the *top* end of the reaction coil and the detector anode.

"H. J. B." (Manchester) raises a rather pertinent query. Having seen some short-wave sets, he says : "I can't understand how readers log this and that station with certainty. It *must* be guesswork, saying 'He's just below W 2 X A F, therefore he must be So-and-so,' and no waiting for identification."

Yes, "H. J. B.," I cordially agree. I don't want to put any reader's back up, but I'm afraid guesswork and imagination are used quite a lot in some quarters.

How often have I pleaded for calibrated receivers ! I shall have to write another article on that subject. Thanks for the other news, "H. J. B."



SPECIAL S.-W. VALVES. An amateur transmitter, G 5 U K, who has been conducting tests on some new types of Marconi transmitting valves, one of which he is seen holding in his hand.

"F. R. J." (Brighton) reports speech from W X Y Z in the region of 45 metres. Though this call sounds rather piratical, I think it is probably an American telephone station.

Essex v. Herts.

"W. T. W." (Burnham) confirms that the station X Z L 5 F, mentioned by several readers, is used by a boat. From the "X-New Zealand" call I should imagine that either the boat or the operator hails from that part of the world. "W. T. W." uses short-wave receivers in two locations—Burnham-on-Crouch and Bushey, Herts. He finds the two places similar in most respects, but, if anything, Bushey is better for short waves and Burnham better for medium waves.

Send Your Photos.

"W. W." (Exeter) forwards some photos of his "den," which, though interesting, are not quite clear enough for reproduction on this page. Will other readers take this tip and send me photos for publication if they consider them good enough ? The Editor asks me to say that they will be paid for at the usual rates.

To return to "W. W." He has been active on short waves for just two years, and he sends me his complete log for the period. He doesn't seem to have missed much, except, perhaps, a little sleep now and then !

Another marvellous log comes from "F. V. E." (Tottenham). I am always delighted to receive these logs and to compare them with my own.

W. L. S.

ROUND the RECORDS

Selections and recommendations from the latest gramophone lists

THE wanderer has returned! Max Kester, one-time "uncle" in the B.B.C., left that Corporation some years ago to join H.M.V., where he has had a lot to do with the artistic side of recording, and recently has co-operated with Ray Noble in the writing of dance numbers and the musical items for films. Evelyn Laye's latest film, *Princess Charming*, owes its music and lyrics to the Kester-Noble combination.

And now Max Kester is once more on the move—back to the B.B.C., where he is going to assist Eric Maschwitz (husband of "Mrs. Pullpleasure") in the production of broadcast variety. He should be an invaluable asset.

I have already mentioned one of the *Princess Charming* records (last time), and here is another that is well worthy of attention. The titles on the disc are "Brave Hearts" and "Near and Yet So Far." The words for the former, so the story goes, were written by Max Kester on Paddington Station in a dense fog ! (BS136.)

POPULAR PLANTATION SONGS

"Wagon Wheels" (H.M.V. BS135) is the latest Paul Robeson song, and it made a minor hit immediately. It is obtainable in all sorts of renderings by all sorts of singers and bands and on all sorts of gramophone records ; but the best is undoubtedly the original, sung by the wonderful basso himself. On the reverse side of the record is "Mammy's Little Kinkly Headed Boy," a plantation song of typical Robeson charm.

An unusual piano record (aren't there a lot of them nowadays ?) is that by Carroll Gibbons and Johnny Green on Columbia DB1333. It is worked out as an argument between the two friends (they are both Americans, of course) as to the best rendering of Green's *Living in Dreams* and Gibbons' famous *On the Air*. The result, after much artificial argument, with polite, endearing phrases, is that both play their own versions, with unusual results. Rather a childish conception of little musical interest.

Twenty-four inches are devoted to the recording of Marie Burke's "My Songs From the Shows" on Columbia DX572, when famous successes from *Show Boat*, *Song of the Drum*, *Waltzes From Vienna* and *He Wanted Adventure* are sung by the famous actress and film star.

With 800 and more performances to its credit the original run of *The Arcadians* was one of the greatest pre-war musical comedy successes. Recently the broadcast version was widely acclaimed, and so will be the Columbia twelve-inch record of the Arcadians' "Overture" just released. The overture from "The Mousme" is on the other side. (DX573.)

"Dixie Lee" is undoubtedly Layton and Johnstone meat. And they sing it in their usual faultless style on a Columbia record.

Alas ! after his excellent *Loch Ness Monster* record John Tilley fails to keep it up in his "Maudie" and its accompanying London Transport Board narration on Columbia DX569. I am afraid I did not laugh.

But I was amused by the peculiar effects obtained by Stanelli on his "Hornchestra." It is a record that can hardly fail to be thoroughly amusing, if not exactly musical.

Stanelli is a collector of motor horns—klaxons, pip-squeaks, pre-war hooters—and has a marvellous museum of these instruments for "giving audible warning of approach," as the law would have it. From this collection he has picked out an orchestra (hornchestra, he calls it), and has mounted his instruments on a sort of iron bedstead back.

It includes a full keyboard of klaxons, and on this motley array of "instruments" Stanelli gives us, after an amusing introductory talk, *I Want to Be Happy*, part of the *Hungarian Rhapsody No. 2* and *Peter, Peter*. The effect is amusing and educative. Don't miss this record if you have a grain of humour. (Decca F3922.)

MILITARY BAND SUCCESSES

A Decca disc of inevitable popularity is "Edith Day Memories," on which both personality and voice of the famous actress have been captured. Drury Lane successes revived in most tuneful fashion. (K725.)

Albert Sandler should be heard with his Orchestra on Columbia DB1332 when he plays "Love's Last Word." It is tuneful and, as usual, beautifully played.

Also worth hearing by those who are fond of military bands is the B.B.C. Wireless Military Band recording of the "Grand March from Tannhauser." On the other side is the introduction to Act III of "Lohengrin" (Columbia DB1341).

An exceptionally fine recording in the recent Decca Polydor list is the funeral march from *The Twilight of the Gods*, the last of Wagner's *Ring* operas. On CA8173 the Berlin Philharmonic Orchestra, under the ægis of Wilhelm Furtwängler, provide a marvellous recording. It is full of tone and depth, and is one of the best full-orchestra records I have heard.

Back to the lighter side with Carlotta Tauber singing "Play to Me, Gipsy" and "One Life, One Love" on Brunswick 01705. This is the soprano's first record for Brunswick, and provides yet another of the biggest Tango hits for years. By now, of course, the plugging of this item is ceasing, and we are awaiting the pundits' proclamation of another big bang in the dance world. There are two or three I have my eye (or should it be ear ?) on, but I am going to make no rash prophecy.

SOME FAVOURITE BROADCASTERS

If you are not fond of the Boswell sisters, whose "Coffee in the Morning and Kisses in the Night" record I mentioned last time, you may like to try the same diet as dished up by Gus Arnheim and his Orchestra in dance form. Get your dealer to play it over for you—Brunswick 01710.

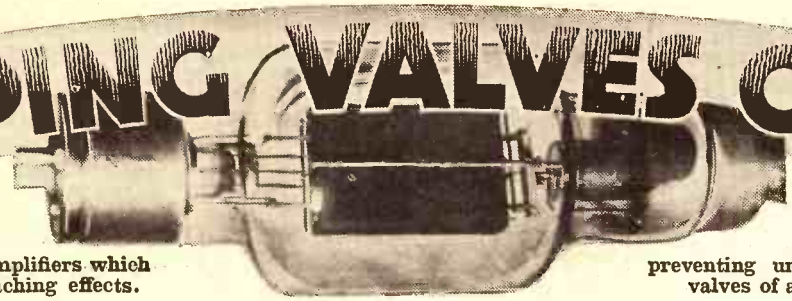
In Town To-night—i.e. "Knightsbridge"—is still going strong, Regal-Zonophone having released a record of it, coupled with "Westminster" by the same composer, played by the ever-popular Commodore Grand Orchestra. I like their rendering very much. (MR1240.)

The Street Singer, famous American wailer, Arthur Tracy, has switched over to Regal-Zonophone and has just made his first recording for them. Hitherto he has been a Decca artiste. I understand that in his boyhood Tracy *was* a street singer in order to buy a gramophone and records of a celebrated tenor on whom it is said he modelled his voice.

Sam Browne and His Girl Friend (Elsie Carlisle ?), who are popular in the Ambrose broadcasts, are to be heard on Regal-Zonophone singing "Gee, Oh Gosh, I'm Grateful !" and "What's Good for the Goose is Good for the Gander" (MR1254).

K. D. R.

KEEPING VALVES COOL



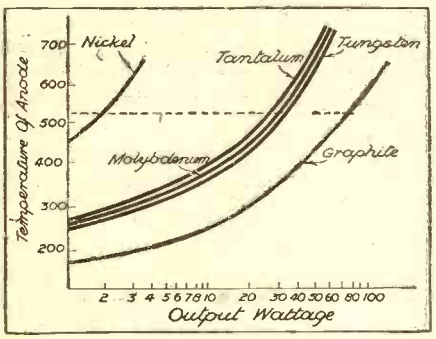
Details of a new development in the construction of power amplifiers which may have most far-reaching effects.

How the graphite anode helps in preventing undue temperature rise in valves of a large power wattage.

PROBABLY all my readers have seen, even if they are not familiar with, radio valves running with red-hot anodes. Those big modulators used by the B.B.C. at Olympia and other radio exhibitions all get so hot that their anodes are bright red, almost white.

Smaller valves than these also get hot, and when a small valve tends to get red-hot things begin to get awkward. For one thing, a hot valve—as hot as that—is not nice to have in a compact space.

It is the smallness of the anode (compared with the power wattage it dissipates) that causes the heat. So valves of big power, and therefore liable to get very hot, are just not made small. They automatically become large in order to keep the anode as cool as possible. And that is a great pity.



We don't want valves to be big, especially those which we want to use in powerful L.F. amplifiers, where the question of room is naturally important. But we cannot help it. The valves have to dissipate a certain anode wattage to give the power we require. This means heat, and to prevent the anode getting too hot we have to make it large. And there you are!

"There you *were*," I should have said. For the use of a new type of anode has enabled very much cooler running to be obtained—per unit anode size—for a given power output. A 75-watt valve that used to reach an anode temperature of 800–1,000 degrees centigrade now only reaches 300–400 or so.

Cheaper and More Accurate.

This immediately results in several advantages: (1) The anode does not tend to warp; (2) the strain on the other electrodes (grid and filament) due to heat is reduced, and owing to the properties of the new material the anodes can be made much more accurately in size, are cheaper and have the most useful property of taking up gas when the valve is being evacuated, thus assisting the gettering process.

And the new material is graphite! You probably read in the January 13th issue of "P.W." a short description of the Ediswan E.S.75H. valve, which is the first graphite anode type in this country. This valve will be the forerunner of many others; and although we cannot expect graphite to be used for the anodes of small receiving valves, it will probably be utilised for the 5-watt undistorted output types (25-watt dissipation), thereby allowing their size to be reduced and also cheapening production.

A Clamping System that is Rigid.

Experiments have been going on for a long time with carbon and graphite as anode material, and most of the snags in production have been ironed out. Fixing has been a bugbear, but this has been overcome by a clamping system that is perfectly rigid and makes good contact.

The close tolerance to which the graphite anodes can be worked in size and shape will greatly assist in the obtainment of more standard valve characteristics, for the tendency of molybdenum and other metal anodes to warp during manufacturing processes has always thrown a difficulty in the way of valve makers.

But, of course, the heat-dissipating power of graphite is the chief advantage, enabling as it does size to be kept down or, alternatively, output power to be put up.

The graph shows how the various most-used anode materials react to electron bombardment during their operation in a valve. All the anodes concerned were of the same size, and the wattage dissipation was varied while the temperature of the anodes was noted. From the curves can readily be seen the great advantage of graphite over the metals, showing (1) how more power per unit temperature rise can be obtained, or (2) how less temperature rise per unit power dissipation is experienced.

The Effect of Different Materials.

The graph clearly shows that while 75–80 watts are obtained from a graphite anode before it reaches red heat, only 30 watts are available from a molybdenum anode of the same size, 35 watts from tungsten and 25 from tantalum. Nickel is nowhere in it for usefulness at all.

How far the new type of anode will affect the power valves we normally use in our sets remains to be seen. These valves do not get seriously hot—at least, not the 2–3 watt A.C. output types. The larger valves, such as the P.P.5/400, run at very much higher temperatures, though these do not reach red heat.

But here the new anode material might usefully be employed to give the possibility of greater output power with the same temperature rise, or to provide smaller valves of the same power.

Bigger Economy.

From the manufacturer's point of view the economy in material and accuracy in moulding should be of benefit in these large valves, and I should not be surprised to see the 25-watt dissipation types (about 5–7 watts A.C. output) using graphite anodes.

This should assist builders of powerful radio receivers and amplifiers to combine output efficiency with compactness of design.

D. L.

THREE NEW TYPES

The photograph is of a trio of carbon anode valves made by Ediswan and the first British valves to be designed using the new material. On the left is a 250-watt dissipation power valve for public-address systems, and in the centre a 75-watter for smaller amplifiers. The big fellow is a 1,500-watt valve for short-wave transmission. The diagram denotes the change of temperature experienced by anodes of the same size but different materials, as used in a 75-watt class of valve. The dotted line represents the temperature at which change of colour due to heat occurs in the anode.

MOSCOW WANTS DR. BOULT.

THE LATEST NEWS AND VIEWS ABOUT BROADCASTING AND BROADCASTERS

DR. ADRIAN BOULT, Music Director of the B.B.C., has been invited by the U.S.S.R. to conduct a special series of six concerts, three in Leningrad and three in Moscow.

The Russians want Dr. Boult to go over next season. This, however, he cannot manage, because he is already committed to an American visit early in 1935. I believe it is likely that Dr. Boult will go to Russia in the autumn of 1935. His reputation abroad is steadily growing.

S.O.S.!

S.O.S. and police messages broadcast by the B.B.C. during 1933 resulted in 44·75 per cent proving successful and 49·18 per cent unsuccessful, while the result of 6·07 per cent was unknown. In all some 858 messages were broadcast from B.B.C. transmitters during the year.

Studying Staff Background.

During the recent Press attacks there was a feeling in the administration at Broadcasting House that hostile newspapers were employing agents inside the building. It was only on some such theory that chronic leakage of information could be accounted for.

As a result, I hear that an exhaustive examination into the "pasts" and origins of all members of the staff has been instituted.

* * *

There May Be Changes.

The Board of Governors and the Government itself feel that, in such an important business as broadcasting, there should be no lack of information concerning the antecedents of all concerned. The investigation covers ethnological and occupational background, as well as political and religious tendencies.

It has not yet been decided whether to make changes as a result of the investigation.

* * *

The Albert Hall Organ.

The B.B.C. has been conducting some special tests of the broadcasting qualities of the Albert Hall organ. A few weeks ago Mr. Quentin MacLean played for broadcasting. The report of the specialists was that it was impossible to get satisfactory broadcasting results.

This is no reflection on the organ or the hall for their ordinary purposes.

* * *

Talks Troubles.

Recurrent troubles with talks have so involved the B.B.C. in the past two years that there is being considered now a drastic revision of attitude towards the spoken word. There are fairly definite indications that the days of the "Central Elephant"—that is, the Central Council for Broadcast Adult Education—are numbered. This is the body that has forced the pace for the B.B.C. in mapping out "advanced" and "stimulating" talks, challenging orthodoxy and unsettling fixed ideas in various directions.

The reason why the Central Council may dissolve is that it may not accept the new policy of restraint which the B.B.C. is adopting in self-preservation. It is believed to be the main function of Colonel Alan Dawnay, the new programme chief, to see that talks are kept within reasonable limits.

The B.B.C. Dance Orchestra, who, with Mr. Henry Hall, are to appear on the stage of the London Palladium in the summer.

* * *

Sir John Reith and Criticism.

Sir John Reith is commonly supposed to be very sensitive to personal attacks in the Press. I have been investigating, and I find that this is not so. If personal attacks on him cause any emotional reaction it is more of amused interest than resentment.

On the other hand, he violently resents unfair or unfounded attacks on his organisation or staff, and he has a singularly long memory where his sense of injustice is aroused.

CHILDREN'S HOUR IN HOSPITAL.

A ward of the Great Ormond Street Hospital for Sick Children will serve as "Children's Hour" broadcasting studio on May 19th.

* * *

Little Known.

What a pity it is that Sir John allows himself to be kept in almost monastic seclusion from the ordinary contacts of life!

When he goes to the Athenæum he talks amiably enough to the bishops there; but up at the Big House he either avoids or is prevented from meeting any of those whose job in life it is to write about broadcasting and all its works from day to day.

Also, although it is not true to say that the B.B.C. is run tyrannously or is seething with unrest, it is true that its Head is far too little known to his staff except for the small proportion that has been with him since the beginning. The unfortunate thing is that a lack of the personal touch may discount much good work and positive achievement.

PLAYS!

On May 3rd two short plays will be relayed from the Birmingham Repertory Theatre studio. One is an Arabian Night comedy, "Ali the Cobbler," and the other one of Maurice Baring's diminutive dramas, "Catherine Parr," in which that queen is shown at breakfast with Henry VIII.

A New Pianist.

By the time these notes appear in print listeners will have had an opportunity of hearing the new pianist with the B.B.C. Dance Orchestra directed by Henry Hall. He is Bert Read, aged twenty-four, and formerly with Ambrose's Orchestra. He has already broadcast many times with this band.

* * *

Modern Interpretation.

Eight years ago, when he was but sixteen years old, Read was playing with Jack Payne's Band at the Hotel Cecil. Besides being a pianist, he is also an arranger of dance music, and he will undertake some arranging for the B.B.C. Dance Orchestra.

At the piano he specialises in modern interpretation, but never strays too far away from the melody.

* * *

A Strong "Bill."

London Regional listeners on May 2nd will hear a particularly interesting variety relay from the Pavilion Theatre, Liverpool, when a selection from the following "bill" will be broadcast: Marie Kendall and her Family, Herschel Henlere, Horace Kenney, Johnson Clarke, Jimmy Charters, Jay Morelle, The Five Canadian Wonders and Gaston and Andree.

* * *

Scrapbook of 1914.

Personalities and events of the years 1913 and 1909 have already been dealt with in Leslie Baily's "Scrapbook" programmes, of which another edition will be presented for National and Regional listeners on Tuesday and Wednesday, May 8th and 9th respectively.

Mr. Baily intended that the form of his next "Scrapbook" should remain a mystery until the actual broadcast, but the secret has leaked out that it will deal with memories of one of the most momentous years in the history of the world—1914.

* * *

"Ridgeway Parade."

The next "Ridgeway Parade" broadcast will positively take place on Friday, June 1st, and will be repeated on the following evening.

Here is good news for those who like Mr. Philip Ridgeway's breezy, if somewhat noisy, shows, which, but for heavy bookings at provincial theatres, would have been given a place in the broadcast programmes at the early part of this year. O. H. M.

The
VARIABLE
COLVERSTAT
TYPE S.T. 5.C.

The supreme variable resistance, with unique smoothness of control and complete freedom from noise. Protected windings. Rating 5 watts. Standard values 250 to 25,000 ohms.

3/6

THE FINEST VARIABLE RESISTANCE YOU CAN BUY

You cannot buy a better variable resistance than the Colverstat, for, like all Colvern products, it is beautifully, accurately and precisely made. Specify Colvern products for your set and you can depend on getting the best results.

Write to-day for the latest Colvern booklet, Radio List No. 12, to Colvern Ltd., Romford, Essex.

COLVERN

Autoparafeed L.F. Transformer List No. DY45.

6/9

AUTOPARAFEED

Autoparafeed is the leading transformer in over 75% of modern sets. Its patented system of coupling and construction ensures greatest amplification possible without distortion. It is the transformer that transforms the quality of reproduction from mediocre to excellent. Autoparafeed has an inductance of 84 henries, and gives a marvellous N. P. L. response curve of 25 to 8000 cycles—get the Parafeed Brochure on Parallel Feed amplification—post free.

The Advertisement of Radio Instruments Ltd., Croydon.

MODERN RADIOGRAM CABINETS ON H.P. TERMS

CASH PRICE
69/6
OR C.O.D.

Carriage Paid.

Specifications of Two Models in our Range.

"Westminster."
3' 3" high, 2' 6" wide, 1' 4" deep.
Made to take all makes of pick-ups, turntables, motor and speakers; also sets up to 18" × 8". Holes will be drilled, or vignettes, free of charge. Side cupboards will take both 10" and 12" records. Complete with chromium handles and guaranteed clock. Supplied in walnut, oak and mahogany at one price.
H.P. Terms: Deposit 15/-. 6 monthly payments of 10/6.

"Windsor."
3' 3" high, 20" wide, 1' 4" deep.
Taking all accessories as "Westminster" model except clock and side cupboards.
Both models are fitted with hinged motor-boards. Supplied in walnut, oak and mahogany at one price.
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CASH PRICE
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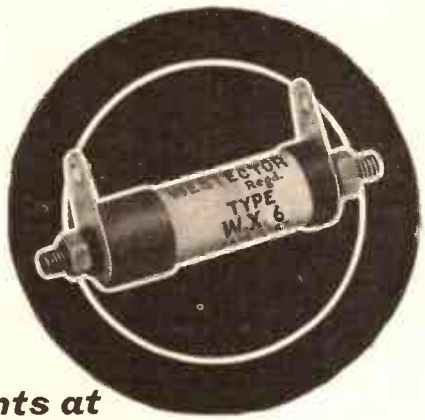


Currents at frequencies of up to

1500 KILOCYCLES

may now be adequately rectified by means of the

WX WESTECTOR

——the new metal detector

WRITE FOR DESCRIPTIVE LITERATURE.

THE WESTINGHOUSE BRAKE & SAXBY SIGNAL CO., LTD.
(Dept. P.W.), 82 York Road, King's Cross, London, N.1

PITCH.

The frequency of a musical note. The term is also used to denote the balance of response of loudspeakers, pick-ups and other devices.

When, for example, a loudspeaker is said to be "high pitched," this means that it gives a better treatment to the high notes than to the low notes.

Or, put in another way, a loudspeaker proportionately deficient in low notes is "high pitched."

But it should be noted that the fundamental pitch of any one musical note is fixed; its timbre or characteristic tone depends upon the harmonic frequencies which accompany it.

PLATE.

The anode of a valve. Plate voltage is the voltage difference existing between the plate and filament of a valve. This will not be the total voltage across the terminals of the H.T. battery (or mains unit). A certain proportion of this will be lost in the resistances, choke or transformer windings or other apparatus in series in the plate (anode) circuit.

Voltage drop in such apparatus is easy to calculate by Ohm's Law if the anode current and the resistance of the components in question are known.

For instance, there might be a decoupling resistance of 25,000 ohms and the primary of an L.F. transformer of 1,000 ohms resistance in series. This gives a total of 26,000 ohms resistance.

If the anode current were 1 milliampere, then, as Ohm's Law says voltage equals current multiplied by resistance, the voltage drop through those two components would be 26 volts.

This voltage subtracted from the total H.T. voltage across the circuit would give the plate voltage, and it is this that figures in the data concerning the operation of a valve, not the total voltage applied by the battery or unit.

PLUG.

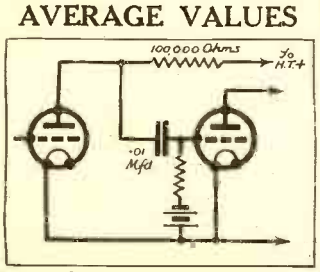
A device for facilitating the connection and disconnection of electrical apparatus. The most common application is to mains radio sets or units.

There are two types of plug in general use. The first is the "bayonet" for fitting into lamp sockets. Secondly, we have the pin type for power sockets. Usually there are two pins, but in cases there are three pins, one being an earth connection.

The bayonet type should be employed only for fairly low currents. The pin varieties are made in several sizes, the "five ampere" being quite suitable for the majority of radio requirements.

The set should always be switched off before inserting or withdrawing a plug, otherwise arcing will almost inevitably occur.

AVERAGE VALUES



This is the same circuit as that in the centre of the page, but the average values of the resistance and capacity are marked.

Power valves are rated by their outputs. A small power valve suitable for operating a small loudspeaker will have a power output of the order of one hundred and fifty milliwatts. A large or super-power valve will rate up to six or seven watts or more.

RESISTANCE-CAPACITY COUPLING.

Both high-frequency and low-frequency valve stages can be linked together by this method. But it is not often applied to H.F. amplifiers, because, with these, designers usually give preference to a method which introduces tuning in order to increase selectivity. In addition, resistance-capacity coupling is not likely to provide good amplification.

Even when the method is employed for coupling low-frequency amplifying valves it compares unfavourably with the transformer method from the point of view of amplification, for there is no voltage step-up in the coupling link itself as with a transformer.

As its name indicates, resistance—capacity coupling makes use of a resistance and a condenser. The resistance is placed in the anode circuit of the first valve, and the voltages set up across this are transmitted to the second valve through the condenser.

Another way of looking at it is to say that the grid and filament of the second valve are "bridged across" this anode-coupling resistance. The diagram above makes this clear. It shows exactly the same circuit as does the first diagram, but drawn in a way that clearly explains this point.

The anode circuit of the first valve is drawn in heavy lines. The current flowing in this anode circuit rises and falls in accordance with the fluctuating voltages fed on to the grid of the first valve.

But the resistance of the coupling resistance remains constant at its 100,000 ohms (the average value used). Therefore, as the current alters in value, it is clear that the voltage across the ends of the resistance must vary (the H.T. battery can be ignored, as its resistance is comparately small).

The grid and filament of the second valve are bridged across the resistance, and the voltage difference between them is varied. And that is the same thing as saying that voltage variations are fed on to the grid of the second valve.

The purpose of the coupling condenser is to ensure that direct-current flow from the H.T. battery is not imposed on it. And as it is, therefore, a barrier against a comparatively high voltage it is essential that it should be an efficient component. Mica condensers are generally specified for the task.

A grid leak is necessary for the second valve in order that its grid can be properly biased by means of a grid-bias battery.

The value of the coupling resistance is determined by the characteristics of the first valve.

HOW R.C. COUPLING WORKS

A PAGE FOR BEGINNERS.

By G. V. DOWDING, Associate I.E.E.

Radio terms simply explained in language :: which everyone can understand ::

PLUG-IN COILS AND TRANSFORMERS.

Such components do not necessarily differ in fundamentals from any others, but are merely fitted with plugs and sockets in order to enable them easily to be interchanged.

POWER VALVE.

This is not a valve which by itself is able to amplify to a greater extent than, say, an ordinary L.F. valve. (Nor does a super-power valve necessarily amplify more than a power valve.)

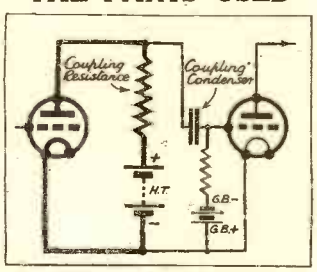
The power valve is so called because it is called upon to deliver a power output, generally to a loudspeaker.

Most valves are voltage operated, so that it is the job of an H.F. or detector valve to pass on magnified voltages to following valves.

The power valve is situated in the last stage of the set; and as loudspeakers are not voltage operated, but need power to drive them (voltage *and* current), it is obvious that it is the task of the power valve to supply this.

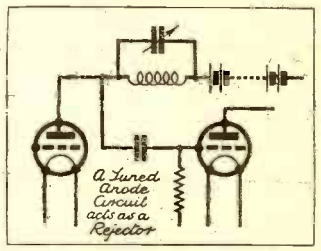
(Class B provides an exception to the general rule. The Class B valve itself has to be power operated, and so is preceded by a small power valve, called the "driver" valve.

THE PARTS USED



A theoretical illustration of the principles of resistance-capacity coupling.

TUNED ANODE



With this circuit only the wanted frequency is passed on to the second valve.

We have mentioned a disadvantage of resistance-capacity coupling as compared with the transformer method, but it is only fair to add that "R.C.C." enables a high quality to be achieved owing to the linearity of response that it gives and its freedom from transient suppression.

REJECTOR CIRCUIT

A circuit arranged to offer a high impedance to a given frequency. An example is to be found in the tuned anode circuit, which often figures as an H.F. coupler in a receiver.

At the frequency to which this circuit, comprising a coil and condenser, is tuned, there will be a virtual barrier to H.F. energy, and this finds an easier path through the coupling condenser to the grid of the next valve.

Other frequencies pass through the coil and condenser with comparative facility. It is useful to note that a parallel-tuned circuit constitutes an efficient H.F. choke to the frequency to which it is tuned.

The "FAR-RANGE" FIVE

A good idea of the general appearance of the receiver is obtained from this photo of the pick-up being placed in position for the reproduction of records.

With the recent development of Class B and the use of the Westector in battery circuits, has come the practicability of battery-operated radiogramophones and multi-valve sets. Whereas such designs were almost prohibitive in their running costs, they can now be worked with really reasonable economy. The set described below is an up-to-the-minute five-valver, employing an economiser circuit and constructed in the form of a table-model radiogram.

Designed and Described by the "P.W." RESEARCH DEPARTMENT.

DURING the last few months reception conditions have been remarkably good. Not only stations in Europe have come in with regularity and strength, but American medium-wave broadcasters have been heard nightly after about 11 p.m.

Due probably to the glamour cast on it by the efforts of Hollywood, America holds more romance, comedy and perhaps tragedy in the eyes of the Britisher than any other country. Thus to receive "the States" is an experience that has attraction well above that held by the picking up of a mere European programme.

Reception of America.

The broadcasting is in our own language, too, albeit in a tongue somewhat clipped and twisted, and that fact increases the value of the reception of, say, Connecticut (which is coming over exceedingly well) a thousandfold.

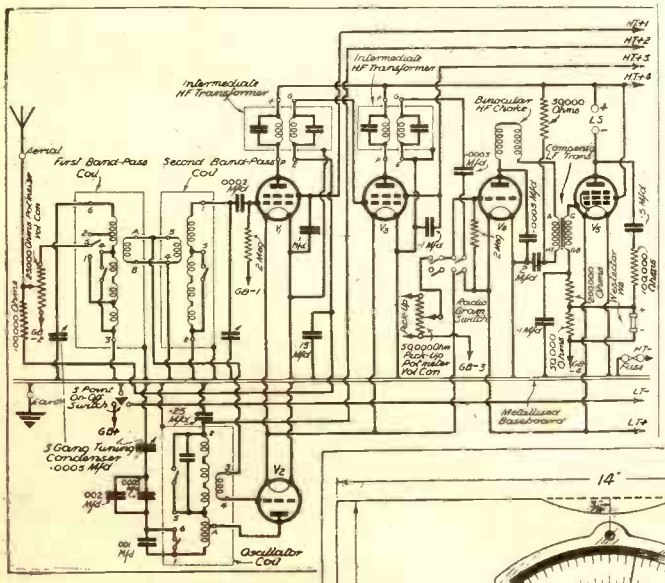
It is often said that music has no nationality. That is true of certain sections of music, though one would not say that the Algerian in "orchestral" broadcasts, for instance, were international in character.

But the non-nationality of music is not sufficient to ensure enjoyment of non-British broadcasts. There are the announcements, the songs and so forth that need understanding before any but a mere fraction of the value of the programme can be obtained. That is the position, as I see it, of European listening. One can get a great deal of enjoyment from the various transmissions of Vienna, Berlin, Luxembourg (with its helpful English announcements), Radio-Paris and so forth. But how refreshing it is to hear a completely new country speaking English, though one has to sit up late to receive its stations!

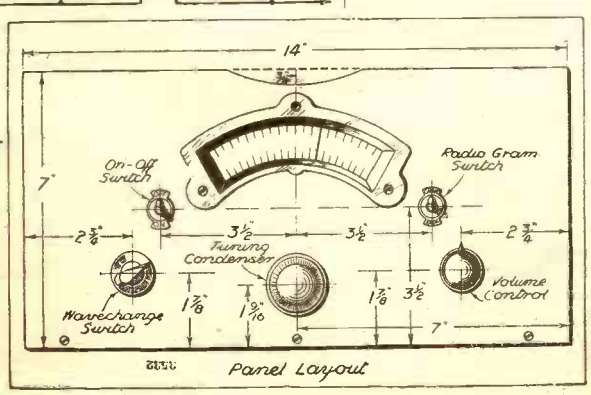
As a tonic after long periods of potpourris of British and Continental programmes a few "Yanks" cannot be beaten. And at the time of writing the "land of liberty" can be heard on the air with wonderful regularity and astonishing clearness.

Obviously, the regularity and the clarity depend on "conditions"—that conveniently vague term that so often covers a multitude of sins—and set design. It is the set mainly (including the aerial-earth equipment) that determines the success of such listening—not mere shades of atmospheric variations or "conditions." With a good set and a good aerial you should be able to hear them across the "herring pond" with surprising ease and certainty, and things will become easier when the new 500-kw. American station starts. But it must be a good set. Not necessarily a multi-valve design, though plenty of valves certainly help, but it must have sensitivity and a fair degree of selectivity, and, above all, it must be easy to manipulate.

HIGH EFFICIENCY WITH GREAT ECONOMY



A band-pass aerial input to the mixer valve ensures a high degree of initial selectivity, while the superheterodyne circuit provides further sharpness in tuning and a very high degree of sensitivity. A pentode output valve and economiser give powerful loudspeaker reproduction without unwarranted consumption of anode-battery power.



THE BATTERIES TO USE

High Tension 120 volts - -	Ediswan.
Low Tension 2 volts - - -	Block.
Grid Bias 16½ volts - - -	Ever Ready.

That is where a multi-valver of the type of the "Far-Range" Five comes in—single-dial tuning, no reaction to bother with, an exceptionally high degree of sensitivity and an economy of running that will surprise you.

It employs band-pass tuning, and is designed primarily as a radiogram of the table type. This form is not essential, however, for the set itself is quite separate, and can be used as a plain radio receiver, minus the gramophone motor and pick-up, without in any way upsetting the design.

Reducing H.T. Consumption.

On the low-frequency side of the receiver a pentode output valve is used, together with a Westector economiser circuit. This allows a very great saving of H.T. to be obtained, especially when the set is used for distant listening. Most readers will realise that the economiser achieves about a 40 per cent saving of H.T. current compared with the consumption of a similar set without the Westector.

(Continued on next page.)

THE "FAR-RANGE" FIVE

(Continued from previous page.)

A single-dial control superhet circuit is employed, an S.G. valve acting as mixer, or frequency changer, with a multi-mu S.G. intermediate, whose volume control is ingeniously used also as an aerial input control. Thus pre-mixing volume setting is attained as well as variation of amplification.

Employs Pentode Output.

Following the I.F. valve is a leaky-grid detector coupled to the "economised" pentode output valve. The detector is switched in to "radio" or "gramophone" at will, while the two S.G. valves and the oscillator are filament controlled by the same switch. On radio the filaments of these three are "on," but when gramophone reproduction is required they are switched "out," thus conserving a great deal of L.T. and H.T. energy.

The design of the receiver is straightforward. The chassis portion is self-contained, and is housed below the speaker and battery platform in the "tablegram" cabinet. A metallised baseboard is used, thereby greatly simplifying the wiring, for many "earth" points are taken direct to the metal covering instead of by long leads to the earth terminal or filament wiring.

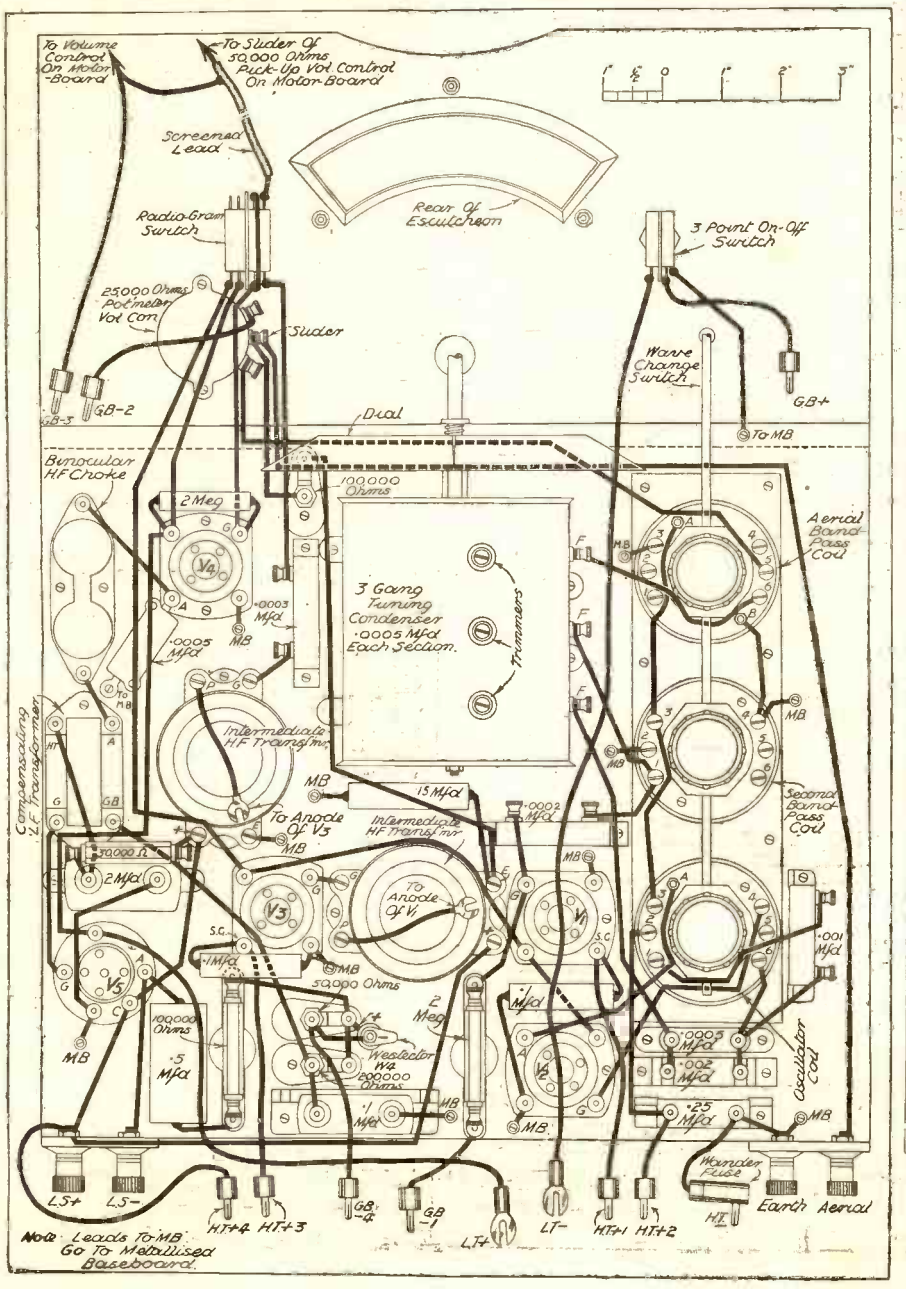
In a receiver of this nature it is especially important to keep to the specification of parts when building, and so we would urge all constructors of the "Far-Range" Five to follow the list of components very closely.

The operation of the set is not difficult,

THE FIVE BATTERY-OPERATED VALVES REQUIRED

Make.	1st Det.	Oscillator.	Intermediate.	2nd. Det.	Output.
Cossor	220S.G.	210H.F.	220V.S.	210H.F.	220P.T.
Mullard	P.M.12A.	P.M.1H.L.	P.M.12M.	P.M.1H.L.	—
Mazda	S.215B.	H.L.2	S.215V.M.	H.L2	Pen.220A.
Marconi	S.22	H.L.2	V.S.24	H.L.2	—
Osram	S.22	H.L.2	V.S.24	H.L.2	—
Tungsram	S.220	H.R.210	—	H.R.210	—
Hivac	S.G.220	H.210	—	H.210	—
Dario	T.B.422	T.B.282	T.B.452	T.B.282	—

A COMPACT AND EASY-TO-ASSEMBLE DESIGN



the single-dial tuning making it extremely simple to tune in the stations. Care has to be taken in trimming the three-gang condenser if best results are to be obtained. It is possible to get two apparently "trimmed" positions for the oscillator section, one of which gives readings above the other on the scale. This is the wrong one.

Trimming the Condenser.

The best way to trim is to screw all three trimmers fully down, and then, tuning to stations below 25 degrees on the medium waves, slowly unscrew the oscillator trimmer (back section of condenser) until a station is heard at maximum strength. Then trim the other two condenser sections, leaving the oscillator set.

When accurate trimming has been accomplished here, switch over to long waves—tune in a weak station round 1,500 metres and adjust the intermediate-frequency transformer trimmers for best results.

As regards H.T., the following voltage will prove about right: H.T.+1, 60–90 volts; H.T.+2, 60–100 volts (should be adjusted carefully on a weak station); H.T.+3, 70–80 volts; H.T.+4, up to 150 volts.

Grid bias is set as follows: G.B.—1, found by trial, 1·5–3 volts; G.B.—2, 9–16 volts; G.B.—3, 1·5 volts; G.B.—4, 13·5–16 volts, or roughly twice the normal for valve used. Employ as much voltage here as is possible with good-quality reception.

How Economy is Achieved.

In conclusion, it may, perhaps, be of interest to many readers if we say a little about the operation of the battery economiser incorporated in the "Far-Range" Five and give some details of the necessary change in resistance values for different output valves.

The whole idea of the economiser is, of course, to limit the flow of anode current in the output of the last valve in the same way as the current of a Class B valve is limited.

The Class B valve, as is well known,

(*Continued on page* 170.)

All the wiring is shown on this diagram, since the whole of the assembly is above the baseboard. A number of earthed points are taken direct to the metallising by means of screws and washers, such points being marked "M.B."

FAR-RANGE FIVE
• S.T. 500 • BIFOCAL 3 •
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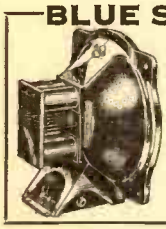
BLUE SPOT "STAR"



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The Speaker with the New Magnet. Complete with extension speaker sockets, on-off switch and universal transformer for matching ANY OUTPUT STAGE. Cash or C.O.D. Carriage Paid, £3/10/0. Send **6/6** only.

Balance in 11 monthly payments of 6/6.

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NEW BLUE SPOT 29 P.M. PERMANENT MAGNET MOVING-COIL SPEAKER. With input transformer. Cash or C.O.D. Carriage Paid, £1/12/6. Balance in 6 monthly payments of 5/-. Send **5/-** only

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2/6 DOWN

ROLA FR6 PM23 CLASS B SPEAKER, with input transformer. Cash or C.O.D. Carriage Paid, £1/19/6. Balance in 9 monthly payments of 4/6. Send **4/6** only

B.T.H. SENIOR PICK-UP AND TONE ARM WITH VOLUME CONTROL. Cash or C.O.D. Carriage Paid, £1/17/6. Balance in 7 monthly payments of 5/-. Send **5/-** only

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Complete with Speaker Cash or C.O.D. Carriage Paid. **55/-**

Or send only 6/- *Balance in 11 monthly payments of 5/-*

SUITABLE FOR ANY BATTERY SET

FAR-RANGE FIVE

KIT "A" CASH or C.O.D. £8-5-0

KIT "A" Author's Kit of First Specified Parts, less Valves and Cabinet. Cash or C.O.D. Carriage Paid **£8-5-0**

YOURS FOR **15/3** Balance in 11 monthly payments of 15/3.

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As Kit "A," but with Valves only. Cash or C.O.D. Carriage Paid, £11/6/6, or 12 monthly payments of 20/9.

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As Kit "A," but with Valves, Cabinet and Baffle. Cash or C.O.D. Carriage Paid, £13/15/0, or deposit £1/10/0 and 11 monthly payments of £1/4/6.

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***Oak* TABLEGRAM CABINET**

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Shelf and Baffle-board, 3/6 extra. **Carriage 2/6 extra**

ESSENTIAL ACCESSORIES

		£	s.	d.
1	Set of 5 **COSSOR** valves, as specified ...	£3	1	6
1	**W.B. P.M.4A Microlode** P.M. moving-coil loud speaker	2	2	0
1	**MARCONIPHONE** type 19 pick-up and tone arm	1	12	6
1	**EDISON BELL** double spring gramophone motor		17	6

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KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen Class B Output Choke, Peto-Scott "Metaplex" Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy of "Popular Wireless" Oct. 21st. Cash or C.O.D. Carriage Paid. **£5-5-0**

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As Kit "A," but including 4 Specified Valves. Cash or C.O.D. Carriage Paid, **£7-10-3**

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or 12 monthly payments of 15/6.

KIT "CC" As Kit "B," including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker. Cash or C.O.D. Carriage Paid **£8-19-9**

Or 12 monthly payments of 16/3

If Peto-Scott Permanent Magnet Speaker required add 19/6 to Cash Price or add 1/9 to each monthly payment.

BIFOCAL THREE

KIT "A" Author's Kit of First Specified Parts, including Ready-drilled Panel Baseboard and Westector, but less Valves and Cabinet. Cash or C.O.D. Carriage Paid. **£5-15-0** or 12 monthly payments of 10/6.

KIT "B"

As for Kit "A," but with Valves only. Cash or C.O.D. Carriage Paid, £7/14/0, or 12 monthly payments of 14/-.

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ANY ITEM SUPPLIED SEPARATELY—ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID

Converts your present Battery Set to Class B Amplification. Complete with all necessary components, **including driver transformer, Class B output Choke, W.B. 7-pin valveholder, B.V.A. 240B valve,** wire and screws, etc. **Full-size Blue print,** assembly instructions and diagrams. **Cash or C.O.D. 37/6. Yours for 5/-** down Balance in 7 monthly payments of 5/6.

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NAME.....

ADDRESS.....

.....P.W., 28/4/34.

IMMEDIATE DELIVERY—CASH—C.O.D. or H.P.

THE "FAR-RANGE" FIVE

(*Continued from page* 168.)

takes its power from the H.T. battery in exact proportion to the strength of the "signal" with which it has to deal. In other words, it only uses just as much power as enables it to deal with the strength of the reception at a given moment.

The valve is specially designed for this form of operation, and does not need any additional circuit like an economiser in order to achieve its object. But in the case of an ordinary valve things are somewhat different.

With triodes and pentodes the only ways to cut down the anode current are to reduce the H.T. voltage or to increase the grid bias. Obviously, either is going to restrict seriously the operation of the valve unless some means of automatic control can be devised.

A power valve requires more H.T. when it deals with big inputs of L.F. than when it deals with small ones; but it would be very tricky to have to arrange automatic control of H.T. so that it could take more or less *voltage* as strong or weak inputs were encountered.

Varying the Grid Bias.

An easier way is to vary the grid bias so that the H.T. current is controlled while the voltage remains constant: for grid bias is easily altered by means of a variable voltage applied to the grid of the valve.

If a set is overbiased in the output stage it will be noticed that weak signals are reproduced quite well, while loud ones are badly distorted. To get pure reproduction on strong modulation less bias is required for a given H.T. voltage on the valve.

What the economiser does is to allow the output valve to be overbiased from the battery and then to impose positive bias to nullify the negative bias, the degree of positive being regulated automatically by the strength of the "signal" in the output circuit of the valve.

A Westector and a resistance network are inserted between the anode and filament of the valve, and a little of the anode A.C. energy is tapped off, the Westector rectifying it and providing a positive bias to be applied to the grid of the valve. This positive bias opposes the negative bias from the battery, and thus allows control of the bias on the valve to be automatically regulated by the signal itself.

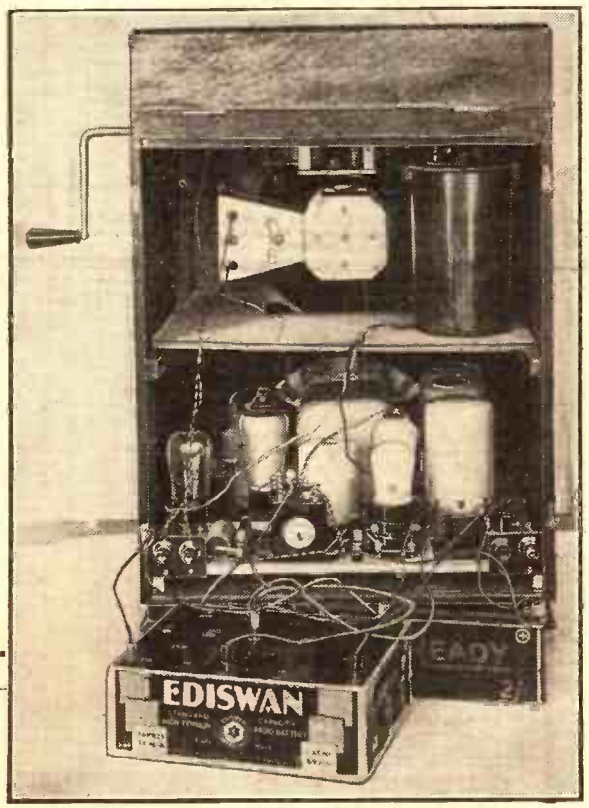
An Important Resistance.

To get the bias correctly controlled it is necessary to have the right balance of resistance values in the network, and so the value of one of these has to be changed in accordance with the output valve used. This resistance is the one between the Westector and the condenser joined to the anode of the valve, and may be anything between 20,000 and 150,000 ohms in value.

For the valves specified in this article the value is 100,000 ohms; but if any other type of valve is contemplated it may have to be altered, and it would be wise to get into touch with the Query Department to check up the correct value.

The connections to the pick-up and its volume control, which is mounted on the motor-board, are given on page 174.

READY FOR RECEPTION



The H.T. battery need not be excessively large, in spite of the fact that five valves are used, for the "economised" pentode in the output circuit takes remarkably little anode current.

THE WORLD-GIRDLERS' LINGO

By W. T. LOWE.

How messages are abbreviated by operators in a hurry.

OWING to the impossibility of transmitting shorthand, an unofficial abbreviated language is often used by telegraphists working on wireless, landline or cable. It is mostly the outcome of co-operation between Press reporters and telegraph administrations for the sake of speed.

The following paragraph relating to graphic wireless history purports to show how a message would be transmitted by the operator. (He would say it is now "old slip," a piece of jargon which denotes an old story).

"Wenevr an S O S sig is hrd, u cn rest assurd tt all othr ships hv stpt wkg. Tt is interntl law. T distress cl is xmtd. T fst ship tt hrs it replis, and asks t stkn vsl fr her postn. Hvg got tt, t fmr puts abt and rushes at ful stm ahed to rendr aid.

When the "Titanic" Sank.

"In t past, whole shplds o passrs hv gone to sea and nvr retnd. T same fate awtd t human cargo o t "Titanic" sum yrs ago, hd it nt bn fr wireless. Wen this vsl ws lnchd, thei sd she ws unsinkable; and, jst to demonstrate t insignifce o man, t ship ran into an icebg and began rapdli to fndr. T senr oprs nme was Jk Phillips.

"T fact tt this ws fst oppy to demonstrate on lge scale hw valuable t sistem ws fr svg life at sea, wun fr him lstg renown."

THE COMPONENTS FOR—THE "FAR-RANGE" FIVE

1 Colvern 3-gang superhet coil assembly, types K.61 : K.62 : K.63.
1 Polar Star Minor 3-gang ·0005-mfd. tuning condenser.
1 Polar "Arcuate" slow-motion drive for the above (scale marked in degrees).
2 Colvern intermediate frequency transformers, type 110.
4 Benjamin 4-pin valve holders, "Vibrolder" type, or W.B., Telsen, Lissen.
1 Benjamin 5-pin valveholder, or Telsen, W.B., Lissen.
1 Bulgin 3-point toggle on-off switch, type S.87.
1 Bulgin D.P.D.T. toggle switch, type S.89.
1 Varley 50,000-ohm potentiometer, type C.P.159, or Erie, Bulgin.
1 Bulgin 25,000-ohm potentiometer, type V.C.34, or Varley, Erie.
1 Dubilier 2-mfd. fixed condenser, type B.B., or T.C.C., Graham Farish, Ferranti, T.M.C.-Hydra.
1 Dubilier ·5-mfd. fixed condenser with wire ends, type 4406, or T.C.C.
1 Lissen ·1-mfd. fixed condenser, type L.N.110, or T.C.C., Dubilier, Ferranti.
1 Dubilier ·15-mfd. fixed condenser with wire ends, type 4404, or T.C.C.
2 T.C.C. ·1-mfd. fixed condensers with wire ends, type 250, or Dubilier.
1 Telsen ·25-mfd. fixed condenser, type W.229.
1 Dubilier ·002-mfd. fixed condenser, type 620, or T.C.C.
1 Graham Farish ·001-mfd. fixed condenser, or Dubilier, T.C.C., Telsen, Lissen.
1 T.C.C. ·0005-mfd. fixed condenser, type 34, or Dubilier.
1 Dubilier ·0005-mfd. fixed condenser, type 670, or T.C.C.
1 Lissen ·0003-mfd. fixed condenser, or T.C.C., Dubilier, Telsen, Graham Farish.
1 Lissen ·0002-mfd. fixed condenser, or Telsen, Dubilier, T.C.C., Graham Farish.
1 Lissen 2-meg. grid leak with wire ends, or Dubilier, Erie, Bulgin, Varley.
1 Graham Farish 2-meg. grid leak 1½-watt Ohmite type in horizontal holder.
1 Graham Farish 200,000-ohm 1½-watt type Ohmite resistance in vertical holder.
1 Graham Farish 100,000-ohm 1½-watt type Ohmite resistance in vertical holder.
1 Graham Farish 100,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
1 Graham Farish 50,000-ohm 1½-watt type Ohmite resistance in vertical holder.
1 Graham Farish 30,000-ohm 1½-watt type Ohmite resistance with terminals, or (with wire ends) Varley, Dubilier, Erie, Bulgin.
1 Telsen binocular H.F. choke, type W.74.
1 R.I. "Varitone" compensating L.F. transformer, or Varley.
1 Westinghouse Westector rectifier, type W.4.
1 Collaro single-spring gramophone motor with automatic stop, or Garrard.
1 W.B. "Microlode" P.M. M.C. speaker, type P.M.4A.
1 Marconiphone pick-up, type No. 19, or Columbia.
4 Igranic "Indigraph" indicating terminals, or Clix, Belling-Lee, Bulgin.
2 ft. Goltone screened single flex.
2 coils British Radiophone "pull-back" wire.
1 Peto-Scott Metaplex baseboard, 14 in. × 12 in., with ⅝-in. runners.
1 Peto-Scott ebonite panel, 14 in. × 7 in., or Goltone, Permcol, Becol.
8 Clix wander-plugs, or Belling-Lee, Eelex.
1 Belling-Lee wander-fuse, or Clix, Eelex.
2 Clix accumulator spades, or Belling-Lee, Eelex.
2 Spade tags for making connection to S.G. valve anode terminals.
1 Peto-Scott cabinet.

REMOTE CONTROL WITHOUT WIRES

THERE must be thousands of listeners who have already made provision for listening in rooms other than that in which the radio set is installed, but it is fairly safe to assume that only a small percentage of these can actually switch the set on and off from any of the loudspeaker extension plug points that they may have "dotted" up and down the house.

Of course, the simplest method of switching the set on or off from a distance (commonly called "remote control") is to run an extra pair of wires along with the normal loudspeaker extension wires, and by short-circuiting these wires by means of switches at the various plug points to operate a relay which is arranged to switch on the filament current to the valves of the set.

Dual-purpose Leads.

The words "simplest method," however, only refer to the electrical side of the problem, for there must be many to whom the running of two extra wires would not be at all an attractive proposition; and it will doubtless come as very welcome news to such as these that it is quite possible to employ one pair of wires for the dual purpose of loudspeaker extension wires and control wires, too.

Naturally, we must expect to pay, in some way or another, for this saving in wiring expense and trouble, and the "payment" in this particular case takes the form of a slight complication of the apparatus at the receiving set.

However, as it is probable that many experimenters will already possess (in the junk box) all the apparatus needed, with the possible exception of the relay, the modification involved should prove a fairly easy matter.

Since control is over the loudspeaker extension wires, the circuit for the operation of the filament-switching relay must be completed by the loudspeaker itself; that is, the connecting up of the loudspeaker by means of a plug and socket at the distant point, will cause the relay to operate and by connecting up the low-tension accumulator to the set, thus cause the latter to function.

Breaking the Circuit.

In the same way the removal of the loudspeaker plug from the extension socket will allow the relay to de-energise, thus breaking the circuit of the valve filaments.

Referring now to the accompanying diagram, it will be seen that a low-frequency choke (L.F.C.) is connected across the loudspeaker terminals of the set, and the loudspeaker itself connected across this choke via a 2- or 4-mfd condenser (C).

One end of the relay coil is connected to the junction between the condenser and one of the extension wires, while to the other end of the coil is connected a short length of flex, terminating in a wander-plug for plugging into the H.T. battery.

The relay, which should have a coil of about 10,000-ohms resistance, should be capable of operating its single-make contacts on about 1½ to 2 milliamperes. No difficulty should be experienced in making a telephone type relay of this resistance operate on the suggested figures.

One contact of the relay is connected to the —L.T. terminal of the accumulator and the other contact to the —L.T. terminal on the set.

Voltage for the Relay.

Now, since the L.S.+ terminal is usually connected in the set to the H.T.+ terminal for the power valve, therefore, in order to obtain the voltage required to operate the relay, we must insert the wander-plug into a socket of the H.T. battery about 15 volts nearer the H.T.— end of the battery than the H.T.+ wander-plug feeding the power valve.

We then plug in the loudspeaker, and, if the relay does not immediately operate, we must increase the voltage applied to it by moving its wander-plug step by step nearer H.T.— until it does.

If the voltage it is necessary to apply seems excessive, and provided the plug and socket connections are in order, it may be assumed that the relay adjustment is at fault. As a guide (in the absence of a milliammeter, with which, of course, the operating current may be read directly), the operating voltage for a 10,000-ohm relay should be 20–28 volts for 2 milliamperes or 10–15 volts for 1 milliampere, depending on the resistance of the loudspeaker.

Battery Life Unaffected.

One great advantage of obtaining the voltage for the relay in this manner is that, in most cases, the relay operating current will be found to have *no effect on the life of the H.T. battery*. This is because in most sets the last 30 or 40 volts of the H.T. battery supply less current than the rest of the battery; for instance, the screen current of a screened-grid H.F. valve is only taken from the lowest 60 or 70 volts of the battery, and in addition many experimenters run a separate H.T.+ lead for their detector valves.

It will be noted that the relay coil is virtually connected in parallel with the loudspeaker; and, although a relay of 10,000 ohms D.C. resistance will usually have quite a high inductance on account of its large number of turns of fine wire, it may happen that with certain designs of relay the inductance is low enough to reduce the sound output from the loudspeaker by an appreciable amount.

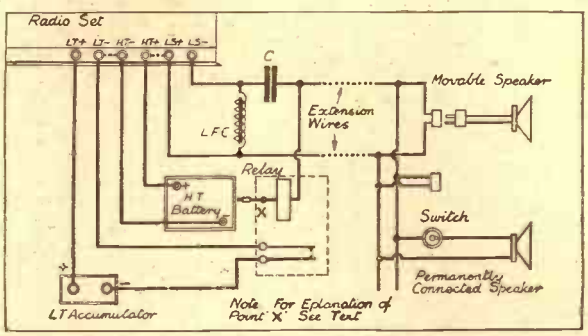
If this is found to be the case, an L.F. choke (the primary winding of an old L.F. transformer will do) should be connected between the relay coil and its wander-plug at the point marked X in the diagram.

A NEW IDEA

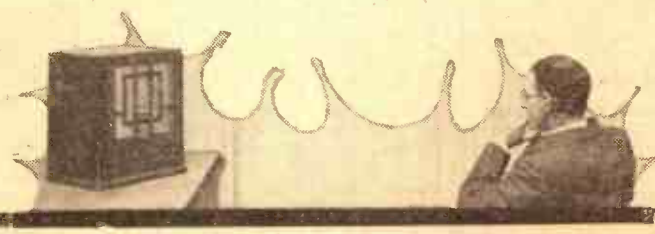
Loudspeaker extension leads are very popular, but without some form of remote control their usefulness is largely curtailed. A method by which the set can be switched on and off at a distance without any extra wires is described in this article

By H. JACKSON, B.Eng.

UTILISES THE LOUDSPEAKER WIRING



No wires beyond those normally already in place for the loudspeaker extension are required to put this system of remote control for the radio receiver into operation. The plugging in or connecting up of the loudspeaker automatically switches on the L.T.



TESTED AND FOUND-?

Being Leaves from the Technical Editor's Notebook

THE CAMCO "RIVERSIDE"

WITH the departure of Easter the portable radio season is well and truly on top of us. I wonder how many will build portables this year. Probably not so many as might if they realised what a great advance there has been in portable-set technique during very recent years.

No longer does the portable radio set take second place to the portable gramophone in the volume and quality it can provide. The vast improvements in lightweight and compact moving-coil loudspeakers and such circuital developments as Class B amplification, etc., render it possible to obtain most satisfactory results with sets not unduly heavy.

Then there have been not inconsiderable improvements in H.F. technique and in set designing in general, so that these modern lightweight portables can provide impressive numbers of programme alternatives.

Substantial Construction.

But a real difficulty for the constructor is the cabinet. Unless he is a very expert carpenter he cannot make anything suitably strong and which has at the same time a moderately good appearance.

The new portable cabinet which every constructor can use for his own circuit design.

This, however, is where the Carrington Manufacturing Co., Ltd., of 24, Hatton Garden, London, E.C.1, come to the rescue.

Their fine and comprehensive range of "Camco" radio cabinets includes a number of excellent cabinets for portable sets

There is, for instance, the Camco "Riverside," which is of the suit-case type. It will accommodate a 14-in. × 6-in. panel, and is suitable for three-, four- or five-valve circuits.

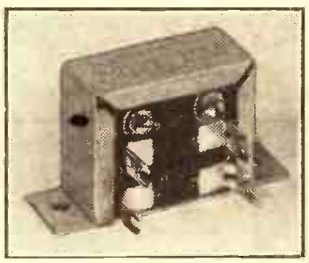
The lid is 4 in. deep, and it is possible to fit a small moving-coil loudspeaker behind the ornamental fret which is supplied and to which the aerial frame is fitted. Access to the battery compartment is obtained by removing a polished cover.

The construction of the cabinet is substantial, but the weight has been kept down successfully. The finish is first class. There is, of course, a lock.

I can thoroughly recommend this cabinet to constructors. We ourselves have frequently used Cameo "Riversides," and no doubt we shall again use them on future occasions.

THE BENJAMIN "AUTOCONTROLA"

On a quite conservative estimate I calculate that something like one thousand kilowatts of power are wasted by the battery sets in this country.



A small unit which can be introduced into your own receiver to cut down H.T. costs by as much as 50 per cent.

One thousand kilowatts!

Enough electrical power to run about twenty B.B.C. transmitting stations; enough to supply five thousand homes with adequate lighting!

How and when is this power wasted? It is wasted by battery power valves. They have to be given certain H.T. voltages, and anode currents of such dimensions have to flow that any volume within the limitations of the valve can be handled without undue distortion.

How often are the limits reached? Very infrequently, and then for only fractional periods of time. Quiet passages of music—above all, programme pauses—could be handled quite well by much smaller valves needing much less H.T. current.

Class B amplification gives you an H.T. current consumption proportional to the volume. But its initial expense is rather heavy, and because you have to add a valve to "drive" the Class B stage what you get is much greater volume at little extra H.T. cost. You may not want more volume.

There is, however, a marvellously attractive alternative. You can add a little unit to your existing set and obtain the same volume, but save valuable milliamperes of H.T. current. The average saving on a normal three-valve set is of the order of 5 milliamperes.

The little unit is the Benjamin "Autocontrola."

It looks something like an L.F. transformer, and it is quite as easy to install in a set. There are no moving or consumable parts in it, and so its life is practically everlasting, but all the time it cuts down its owner's H.T. battery bills to a wonderful extent.

As many of you may guess, it is designed around the famous Westector Economy Scheme, and this is a tried and tested economy method which is already giving satisfaction to tens of thousands of constructors.

The Benjamin "Autocontrola" itself figured in that famous industry set the "Bifocal," and so it carries the recommendation of a wide circle of authoritative experts.

We ourselves have used it and found it entirely satisfactory. It is sold at 7s. 6d., minus the Westector and an external resistance which slip into two convenient pairs of clips.

All those who are interested in the device (and that ought to be many hundreds of thousands!) should write to Benjamin Electric, Ltd., of Tariff Road, Tottenham, N.17, for any further details they may require.

MAGNUM DUAL-RANGE COILS

In our March 17th issue I reviewed the "Magnum" Dual-Range Coil, which is a product of Messrs. Burne-Jones & Co., Ltd., of "Magnum House," 296, Borough High Street, London, S.E.1.

Although, on the whole, my report was favourable to this component, I made certain suggestions as to how I thought it could still further be improved.

For one thing, I suggested that if it were fitted with terminals it would gain greater popularity among constructors, for there are many who simply will not solder. And I cannot say I blame them for that!

Eliminating Break-Through.

I also observed that the coil would undoubtedly be improved if it were fitted with primary windings instead of having direct aerial taps, for it is my experience that break-through is in many districts almost inevitable unless this be done.

This new Magnum coil incorporates several refinements suggested recently on this page by the Technical Editor.

Messrs. Burne-Jones accepted these suggestions in the spirit that dictated their origin (as, indeed, I anticipated they would) and have produced a revised version of the coil in accordance with them.

I can now only say that the "Magnum" Dual-Range Coil is a first-class component against which no criticism could be levelled. Bearing in mind that it is probably the cheapest one on the market, I can visualise its being a best seller, for modern constructors appear to have an uncanny gift for spotting bargains.

THE LINK BETWEEN

Notes of interest to buyers by G. T. KELSEY.

THE "reliability factor" of the present-day commercial receivers has undoubtedly reached a very high standard—a glowing tribute to the perseverance and thoroughness of our British manufacturers. But, even so, however skilfully a set may be designed and however thoroughly that design may be tested prior to dispatch from the works, there is, with radio, always just the element of chance which precludes the giving of an absolutely trouble-free guarantee over an extended period.

Enterprising Manufacturers.

Please do not misunderstand me. The actual percentage of breakdowns after installation is very very small indeed; but the fact that failures—however remote—do occur provides me with a golden opportunity for drawing attention to the enterprise of our manufacturers by their appointment of fully qualified service engineers to attend to such troubles on the spot, so to speak. That's why, providing you buy a "pedigree" set, you need never entertain any fears about service after sale.

These thoughts have been brought to mind by an experience which has recently befallen me, and they are recorded in an endeavour to create that degree of supreme confidence to which—judging by my own experiences—our British manufacturers are justly entitled.

I suppose it sounds a little strange that I should have had to enlist the help of a service engineer, but the reason is twofold. For one thing, I hadn't the time adequately to attend to the matter myself, and, for another, in my "Link-Between" capacity, it occurred to me that the experience might be valuable to pass on to readers.

Any way, to get down to brass tacks, I am the proud possessor of a certain make of commercial receiver, and recently, alas! it developed a slight fault. Without disclosing to the service engineer who attended to the matter that I knew anything about radio, I just left him to get on with it; in fact, he came while I was away, and I did not even see him.

All I wish to add is that if the way in which he performed his duties is typical of service engineers generally, then we in England are indeed fortunate. He did his work nobly, and the set is now working better than ever.

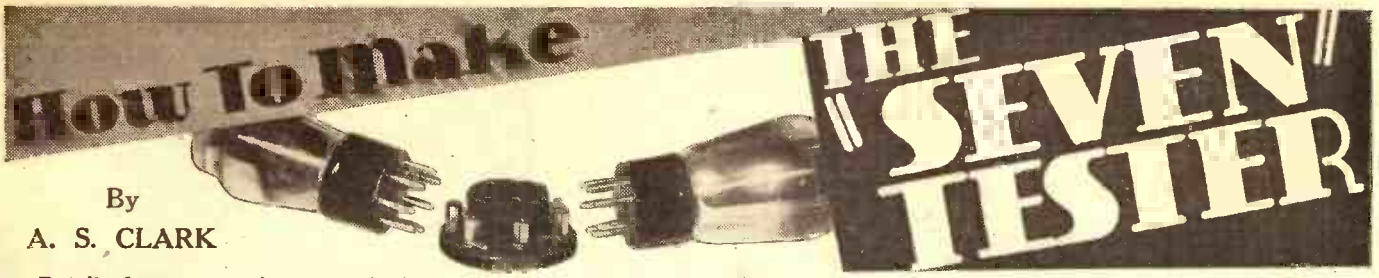
One amusing sidelight. I was duly "ticked off" for using match-sticks instead of wander-plugs, and the curious part of it is that I happen to agree entirely with everything he said about it! 'Tis said that the shoemaker is always the most poorly shod of all men!

However, if from this clue the service engineer in question recognises the "case," perhaps he will make a note of the fact that I should welcome an opportunity of thanking him in person. My only hope now is that not too many other people use match-sticks!

For Short-Wave Listeners.

Last week, in my notes, I had occasion to mention the special headphones which are being manufactured by the National Radio Service Company for the use of deaf persons. It

(*Continued on page* 176.)



How to Make the SEVEN TESTER

By A. S. CLARK

Details for constructing a particularly ingenious unit, which anyone can build, for testing seven-pin valves of all types.

WHEN the seven-pin valve holder was first introduced, to accommodate Class B valves, it seemed a very complicated component. But now we are getting more and more used to it we have to admit that it is quite sane and useful.

It had not long been found in set designs before it became apparent that Class B valves were not to be its only protégé. Other valves, with more contacts than the five-pin holder could provide, made use of it.

Since that time more new valves, such as the Heptode and the double-diode pentode, have made use of the seven-pin holder. Quite naturally, with the new types of valves employing many electrodes, some sort of new base had to be introduced. But now ordinary pentodes are going over to seven-pin bases; indeed, it seems as though the trend of development is towards the complete elimination of all other types of base.

Big Differences.

Be that as it may, there are already enough seven-pin valves to restrict considerably the usefulness of a valve tester which is designed for four- and five-pin valves only. And an instrument to take the new valves is required.

But a "seven-pin" tester is by no means an easy job to design. The difficulty arises, as most readers will appreciate, through the great differences existing between the various seven-pin valves. These differences make it impossible to keep any one pin for the same purpose in all cases.

In one valve, for instance, a certain pin may be the screening-grid contact; in another valve it serves the anode; while in a third it is used for connection to the suppressor grid.

An Ingenious Arrangement.

By an ingenious arrangement of five sockets and six terminals (the connections to the latter being permanently made) the check panel described on this page enables any of the seven-pin valves now on the market to be tested. It is but the work of a moment to connect the milliammeter in any of the anode or screening-grid circuits of a particular valve.

The meter itself has not been included on the panel, because it is an instrument which one does not usually wish to tie up for one purpose only. Two of the terminals on one side of the panel provide the connections for the meter, and thus it is possible to use different meters with different ranges for the various valves, if desired, instead of a multi-range instrument.

Above and Below the Panel.

One diagram shows the panel from the top, and the other clearly illustrates the wiring on the underside. The above-panel diagram is self-explanatory, except for the brass upright.

This provides the connection to valves employing a centre terminal on the top of the glass bulb. The strip is bent at right angles at the bottom and bolted to the panel.

At the top of this strip a short piece of flex, terminating in a spade tag, makes it possible to connect to the terminals of valves with varying height bulbs. The brass strip holds this tag high enough for it not to come into contact with the sockets. The strip should be covered with insulating tape.

The L.T. Pins.

Turning to the wiring, we see that two sockets are permanently connected to the L.T. terminals, since they are always used for this purpose. The second contact joined to L.T. — is always a cathode connection, except when it is unused.

The contact which is joined by the on-off switch to L.T. negative is sometimes a suppressor grid, in which case the switch is closed. In all other cases take great care to have this switch open, or you will "short" something.

G.B. + and H.T. — are joined to terminals. The long flex lead joined to "meter +" goes to H.T., the voltage depending upon the valve under test and whether, say, S.G. or anode-circuit current is to be measured.

The short flex determines to which electrode the meter is connected, according to which of the five sockets it is plugged into. The remaining four sockets are joined by plugs to grid-bias negative taps or to H.T. positive taps, according to the several purposes of the electrodes to which they are joined in the valve under test.

In some cases all five will not be required to be connected. Lengths of flex, with battery wander-plugs at either end, are best for joining the sockets up to the batteries.

It is Best to Use Batteries.

It is also best to test even mains valves by means of batteries, the heavy load for short periods not proving expensive or detrimental to batteries. Remember, you will want 4 volts L.T. for mains valves of the A.C. type, and don't forget to change back to 2 volts when reverting to battery-valve tests.

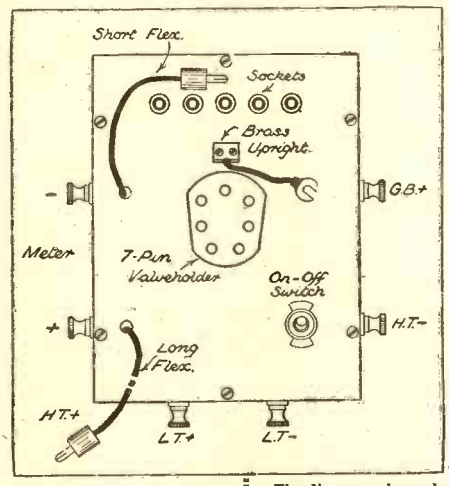
So long as a valve passes current in each of its anode, priming-grid or screening-grid circuits, and this current is about the right value for the H.T. and G.B. voltages applied, the valve may safely be assumed to be O.K. The maker's data and characteristic curves form a satisfactory guide to what readings to expect.

We will suppose a battery-driven H.F. pentode is to be tested. The suppressor grid has to be joined to filament, so to achieve this the switch is placed in the closed (on) position.

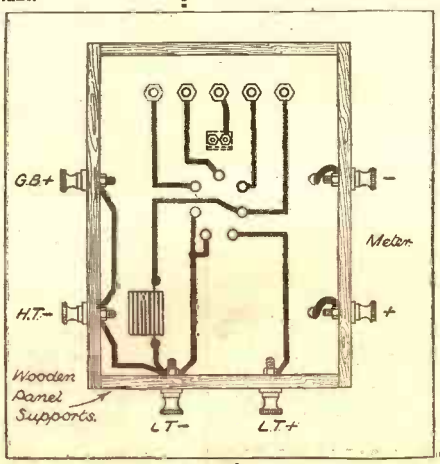
We will presume that the valve is of the multi-mu type, in which case you will probably find the anode current is specified for zero grid volts. So G.B + is ignored. Two volts L.T. are joined across the L.T. terminals.

The right-hand socket, looking at the top of the unit, goes to about 70 volts positive on the battery, the next one is ignored, the centre one goes to the short flex joined to "meter —"; the next socket is then connected to L.T. — The value of the anode current is then read on the milliammeter.

SIMPLE TO CONSTRUCT



The diagram above shows the disposition of the various items on the panel. The dimensions for drilling and the size of the ebonite are not important.



It will be appreciated from this plan that the wiring is easy to carry out and not extensive.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

ADDING AN OUTPUT CHOKE SPOILS QUALITY.

We should like to thank Mr. L. Norman, of Vine Cottage, Tendring, near Clacton-on-Sea, for a friendly letter in connection with the above subject. Having seen that a Derby reader was in difficulty with his set (as recounted in our "Radiotorial" columns 24/3/34), Mr. Norman remembered having exactly the same bother in precisely similar circumstances —same design, symptoms, mains unit, etc.— and he has asked us to pass on particulars of his experience, in case they may prove of assistance.

So if W. W., of Derby (or any other reader), is still suffering from the symptoms described he will probably be glad to know that in Mr. Norman's case a complete cure was effected by decoupling the *second* valve as well as the detector.

INSERTING A MILLIAMMETER TO OBTAIN DIAL READINGS FOR CALIBRATION.

A. R. (Greenock).—"I cannot say how pleased I am with the set ('National Eckerleys Radiogram)', which is just as good on the score of quality as it is in pulling in the distant stations' programmes.

"Tuning is very sharp, so I thought I would draw up a proper tuning curve, and for this purpose I put a milliammeter in the detector's plate circuit to get hairbreadth accuracy.

"Unfortunately, it seemed to upset reaction, so perhaps I had it in wrong, somehow. What I did was to undo the P. terminal of the V2 valve holder and put the lead coming through the baseboard on to the + terminal of the milliammeter, the — terminal on this then going to the P. terminal.

"It seemed to work all right on some stations, but not when I had to use a lot of reaction for the very distant ones. (I see it is recommended that a 1-mfd. condenser should be joined across the milliammeter, but I did not try this, as I do not own one. Would that have cured the trouble ?)"

Probably it would have been better if you had used the condenser, but in any case you had the milliammeter in the wrong place as described.

If placed in series at the valve holder it comes into the reaction circuit, but you could have measured the detector's plate current equally well at the L.F. transformer.

Try undoing the H.T.+ terminal of the transformer and joining the — terminal of the milliammeter to this. Then connect the + terminal of the milliammeter to the wire coming through the baseboard which you have just undone.

Inserted thus, you will probably be able to obtain sharp milliammeter readings as well as quite normal reaction.

LOWERING THE TUNING CAPACITY FOR SHORT WAVES.

H. J. (Shepperton).—"Reading what one of your contributors said about converting an S.G. three-valver into an all-wave three, to cover short waves as well (page 61, March 31st 'P.W.'), I got very interested in his ganged condensers with the switch on the panel to give ·00025 mfd.

"Can this be done with ordinary ganged ·0005's, in which *both* sections are ·0005 mfd. ? Apparently so, but I have been trying to puzzle out how a switch could possibly do this, and I confess 'I dunno.'

"If you can give me the full connections I shall be more than pleased, as this is exactly the problem which I should like to overcome, the short waves requiring to be tuned with a ·00025 mfd. and the medium and long with ·0005 mfd.

"What puzzles me is how he got the low capacity out of two higher ones."

It is simple enough if you remember that when two similar-capacity condensers are connected together in series the total effective capacity of the arrangement is only half that of the separate capacities. In other words, if a ·0005 mfd. is connected in series with another ·0005-mfd condenser the effect is exactly the same as if you had only a ·00025 mfd. in circuit.

If an on-off switch is wired across one of the condensers of such a pair it will obviously permit the total capacity to be altered at will from ·0005 mfd. to ·00025 mfd., and vice versa.

When the switch is in the open position both the condensers will be active, and so the total capacity of the arrangement will be ·00025 mfd., as stated; whilst if the switch is in the closed position it shorts right across one of the sections and so leaves only the other one effective, with a capacity of ·0005 mfd. in circuit.

So in practice the connections could be as follows: Fixed-vanes terminal of one of the sections to coil and grid condenser, as usual. Moving-vanes terminal of this section to moving-vanes terminal of the other ·0005-mfd. section. (This pair of terminals may already be joined by the maker of the condenser by using a common spindle without insulation.)

And, finally, the fixed vanes of the second section to the filament, earth, etc.

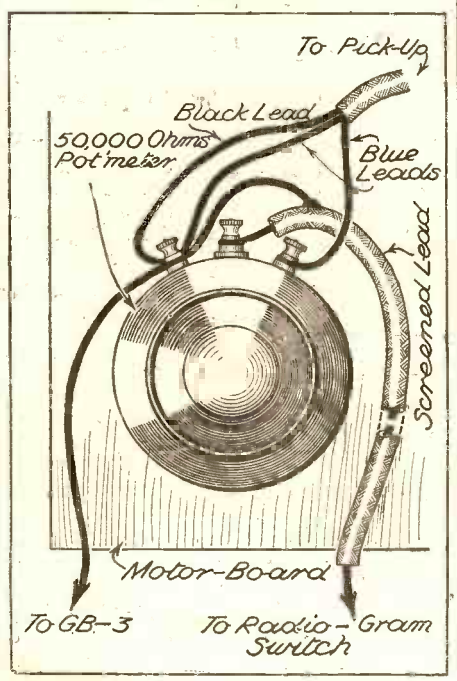
In addition, this latter point is joined to one of the switch contacts. The other switch contact goes to the point where the two sets of moving vanes are joined.

(The switch, it may be noted, is just one of the ordinary make-and-break type, but it should be a good one, of clean action, making firm contact.)

By operating the switch the tuning capacity across the outer (fixed) terminals is thus either ·00025 mfd. for short waves or ·0005 mfd. for ordinary and long waves, as desired.

If the condenser is of the screened type in which the screen is common with the moving vanes, it is important to see that this screening is insulated from the metal baseboard if one is employed.

THE "FAR-RANGE" FIVE PICK-UP CONNECTIONS



The 50,000-ohms volume control for the pick-up is mounted on the motor-board of the "Far-Range" Five, and this sketch shows how the various coloured and other leads are arranged. Note the method of joining the metal coating to the G.B.3 terminal.

"RADIO TERMS."

F. B. N. (Huddersfield).—"I have found so much interesting information packed into your 'Radio Terms' that I should like to get the whole series of these articles. Please say in what numbers they were published and where I should apply for them."

They began in "P.W." No. 597, and continued in Nos. 598, 601, 602, 603, 604, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619 and 620.

Any back number of "P.W." which is still in print and not obtainable locally may be had on application to The Amalgamated Press, Ltd., Back Number Department, Bear Alley, Farringdon Street, London, E.C.4.

The price is 3d. per copy, *plus postage.*

THE "MYSTERY" STATION ON LONG WAVES.

We are still receiving reports of the telephony tests to which reference was made in "Radiotorial" some weeks ago, but so far nobody has definitely identified the station.

Writing from 407, St. Vincent Street, Glasgow, Mr. J. Blair says:

"I notice in 'P.W.' a Mr. Wood, of Andover, reporting the reception of a long-wave station. May I also say that I have heard this station (or stations) working two-way telephony around 375 metres, or 56 degrees on the 'National Eckersley Three' ?

"His report of conversations being in German is quite correct, but I have also heard the same in Russian, Italian and Spanish. I have heard him on two or three nights just after midnight, as if a telephone exchange was in operation; in fact, one could hear the semblance of phone cords and indicators being operated, while the sound of female whisperings were quite clear. At times they must have been very near the mikes, as their breathing was also quite audible.

"The whole operations appeared to be under the control of a supervisor, who would butt in occasionally with a question, and, after what appeared to be a news item, would say quite clearly, 'Dah, dah, dah.' One could also hear them calling 'Europa' several times, later 'New Yorka,' and reply coming back.

"I am grateful for Mr. Wood's information that this station works on L.W., for which I will have a try, and if Mr. Wood will try the M.W. I believe he will be equally and agreeably surprised to hear the same type of information being transmitted.

"Whatever station it may be, they certainly have high power, as I may say I could also hear the running of what did appear to be generators. The picture in my mind was

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from previous page.*)

a great power house with telephone exchange for radio in operation."

Another reader, Mr. F. H. Spencer, of 62, Sherwood Vale, Mapperley, Nottingham, gives some further interesting particulars. He says, in a letter to the Editor:

"I was searching the long-wave band at about 1 o'clock on Saturday morning, March 10th, when I came across the 'mystery station,' which many of your readers seemed to have noticed.

"The conversations were in German, and there were three voices—two men and a woman. Reception of two of the voices was very clear and strong, and there was no fading, but the third voice, that of a man, was very much fainter.

"As far as I could judge, the wavelength was about 950–1,000 metres.

"During one of the conversations the woman mentioned the word 'Amsterdam.' I wonder if this may be of any aid in tracing the transmission. During intervals a strange buzzing and clicking were heard and the faintest voice had a background of that peculiar 'bubbling' sound which often accompanies long-distance cable relays.

"I have endeavoured to find the station two or three times since, but without success. Nobody else seemed to know anything about it, and I had not seen it mentioned in print until I saw it in POPULAR WIRELESS."

WHY DO THE FUSES BLOW?

R. J. H. (London, W.C.1).—"I have just had my battery three-valve set converted to take mains valves (D.C. supply).

"My idea was to do away with batteries altogether—a good idea, maybe, but so far it hasn't worked out right. Because, as soon as I switch the set on, there's a flash and out go all the lights in the house. Main fuse every time.

"As I live in a large boarding house it is, to say the least of it, inconvenient. Can you suggest what is the cause of the fuses blowing?"

An essential feature of D.C. power supply is the earthing of the set indirectly through a large-capacity condenser in series with the earth lead. If this condenser is omitted or faulty it commonly results in blowing the main fuse, as in your case.

Make sure that such a condenser is included in your own earth lead—it is usually placed in the D.C. power unit, the actual connection to earth plate or water-pipe being made by a lead from this unit's earth terminal *instead of from that on the set*.

If your earth connections are duly made via such a condenser and the insulation of this proves to be O.K., there may be an accidental earth, which you will have to locate to cure the trouble.

The aerial or lead-in may cause such an unsuspected earth through touching an earthed gutter, so it is a good plan to put a condenser in the aerial lead, as well as having the one in the earth lead. It need not, however, be a large one (as in the case of the one for the earth lead), but you can use a good-quality ·001 mfd. or thereabouts for the purpose.

Another common place for such an unwanted "outside" earthing point to occur is at the earthing switch. So, if one of these is in use, be sure its contacts are in order, properly connected and insulated.

CURING A PERSISTENT WHISTLE.

S. V. C. (Mitcham).—"I never heard such a persistent whistle before.

"There is only one thing to be said in its favour, and that is—reliability. Believe me, you can rely on it.

"That whistle is there when the announcer starts, and it is still there when he says 'Good-night, everybody.' It is there on the Regional and it is there right on the National, too.

"Foreigners as well? Yes, it accompanies French, German or any other nation.

"If I switch on in the morning before the B.B.C. starts the whistle is there. You can't tune it away and you can't curse it away (I've tried both, and I know).

"It never seems to get any louder, but it never cases up for one moment. A new H.T. battery makes no difference to it, and I don't propose to spend any more on the set unless I can be sure of stopping the whistle once and for all.

"Now I am writing to you as a last resort. And I am writing not to work off my grievance, but to give it one last chance before I scrap the whole outfit. Is there, or is there not, anything I can do about it without spending any more?

"I know that a detector and 2 L.F. set is old-fashioned nowadays, but it is all well wired and well spaced, and everybody who sees it admits that it looks like a good set.

"There is certainly plenty of power behind it, without reaction, if only I could cure it of this one fatal habit. But I can't stick that any longer and I can't spend anything. That's final."

We don't wonder that you are fed up with it. Nothing is more annoying.

But there are two things you can try before condemning the set altogether.

First, try changing over the two leads which go to the primary of the L.F. transformer. If there are two transformers, and the first attempt is not successful, put back the leads to their original positions and change over the primary leads of the *second* transformer instead.

If that does not effect a cure, take off all the leads to one of the transformers and provide it with flex leads instead, these leads being long enough to allow the transformer to be moved about near to its original position, but facing at right angles to its previous placing. (Although you say the spacing is good, there may be unsuspected coupling taking place, and the realignment would cure this.)

The Westector is one of those components that must always be connected the right way round.

FOR BETTER RADIO

It often happens that results are improved when connections to a component such as an L.F. transformer are reversed. But it must be remembered that some components definitely must be connected round the right way. Otherwise serious damage may result.

* * *

Certain electrolytic condensers, marked with + and —, come within this category, and so do Westectors. It is very important to connect them in the right direction, and in no other. And in any cases of doubt, the right connections must be ascertained before switching on.

NEXT WEDNESDAY

An Exclusive Interview
with
Mr. EUSTACE ROBB
(B.B.C. Television Director)
will be one of the many brilliant articles to be found in the

SPECIAL TELEVISION NUMBER OF POPULAR WIRELESS

Easy Terms

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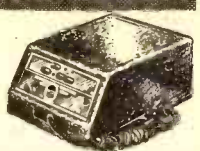
ATLAS ELIMINATOR

SENT ON 7 DAYS' TRIAL



Model C.A.25. Suitable for all outputs, including Class B and Q.P.P. Send only 3/6 for 7 days' trial. If approved, balance payable in 11 monthly payments of 5/6 (or cash in 7 days £2/19/6). Carriage Paid. 3/6 DOWN

D.C. Model 15/25. Cash or C.O.D. Carriage Paid £1/19/6, or 4/- down and 10 monthly payments of 4/-.

BLUE SPOT 29 P.M. MOVING-COIL SPEAKER

SEND FOR IT ON 7 DAYS' TRIAL.

A very popular P.M. Moving-coil Speaker for operation from Power or Pentode. Send only 2/6 for 7 days' trial. If approved, balance in 8 monthly payments of 4/3. Cash or C.O.D. Carriage Paid, £1/12/6. 2/6 DOWN

NEW BLUE SPOT "STAR" MOVING-COIL SPEAKER. Complete with Universal matching transformer. Cash or C.O.D. £3.10.0, or 5/- deposit and 11 monthly payments of 6/6.

N.T.S. CLASS 'B' SPEAKER-AMPLIFIER

Send for it on 7 DAYS' TRIAL

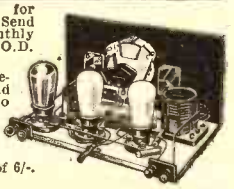
Gives Seven Times the Volume. Ready assembled with Class B Valve. Send only 5/- for 7 days' trial. If approved, balance in 11 monthly payments of 5/6. Cash or C.O.D. Carriage Paid, £2/19/6. **Simply plug-in to your existing battery set.** 5/- DOWN

W.B.P.M. 4 MICRODE MOVING-COIL SPEAKER

SENT ON 7 DAYS' TRIAL

With Switch-controlled multi-ratio input transformer. Send only 5/- for 7 days' trial. If approved, balance in 8 monthly payments of 5/3. Cash or C.O.D Carriage Paid, £2/2/0. W.B.P.M.6. Send only 2/6. Balance in 8 monthly payments of 4/3. Cash or C.O.D. Carr. Paid £1/12/6. 5/- DOWN

TELSEN "323" KIT



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FIRST WITH EASY TERMS IN 1924

THE LISTENER'S NOTEBOOK

Comment and criticism on recent B.B.C. programmes.

I AM not one to attack announcers. On the contrary, I like them, for they do their job well.

That's my honest opinion. Like any other professional men, they will make mistakes sometimes. It takes a big mistake on their part to irritate me. But such an one was made recently. Isleworth was pronounced *Izzle*worth. Ugh! I cannot let that pass! Where were you brought up, Mr. Announcer?

* * *

One is tempted to have a dip at most of the new series of talks now being entered upon. Here are two I've tried which represent two extremes. The one I found absorbingly interesting; the other was the sort of thing that wouldn't fill the Albert Hall the *second* night. I will deal with it first.

It's the series labelled "The Web of Thought and Action." The first talk was just words, words, words. All very high sounding, but devoid of much that was tangible. I shall not be greatly upset if I find myself otherwise engaged on a Tuesday evening at 8.30.

But I shall be terribly disappointed if I have to miss any of the future "What I Believe" talks. The series couldn't have had a better send-off than that given by Mr. E. W. Oaten, the President of the International Spiritualist Federation.

Apart from the subject (of which I am practically ignorant), Mr. Oaten was interesting in himself. He is just the type of speaker I love listening to. He stated his case clearly, plainly and convincingly. His sincerity was ever apparent.

* * *

Mr. Oaten lost several good marks, however, by finding he hadn't time to deal with just the very thing we laymen want most to hear, viz., the nature of the life lived in the spirit world. The most we are told of this are usually trivialities that aren't general enough to convince us. Indeed, they hardly interest us.

I would gladly have done without the discussion at the end of the talk. Mr. Oaten might then have had the necessary time. The discussion didn't help the talk. Rather, it came as a sort of anti-climax that weakened more than consolidated the argument.

* * *

The weekly story improves the programmes. There is no doubt about that. The only snag about it is that one may have read the story before. This was my only fly in the ointment about Winifred Holtby's short story, "The Voice of God." But a good story can always be retold.

Didn't you like that Cavalcade of Variety in celebration of variety's twelfth anniversary? Good, wasn't it? But didn't you think, as always, that it was the patter that scored best? Artistes who sing only can't hold a candle to the patter merchants. A more judicious sprinkling of the patter in this programme would have saved it from the obvious worsening that set in.

All the patter came in a bunch, and the entertainment value of this particular part of the programme reached a very high standard. One noticed that some extra degrees of latitude were given to these star comedians. No, I didn't raise my eyebrows! I heartily approved.

* * *

Clapham and Dwyer confirmed a growing impression of mine that they are now indisputably the stars of variety stars.

* * *

John Henry made a welcome return to the microphone. I hope he won't desert again for so long.

* * *

Didn't John Watt, the compère, say, among other clever things, that Helena Millais made her first appearance as a broadcast artiste three days after Norman Long, on November 31st, 1922? I used to know a rhyme which began something like this: "Thirty days have September, April, June, and . . . ."

* * *

The other Saturday midday an hour of the Commodore Grand Orchestra was followed by an interlude of gramophone records. The very first record to be played was a selection of something or other played by the Commodore Grand Orchestra.

Personally, I am too fond of the Commodore to be irritated by this, but I can understand how irritating it might be to less enthusiastic Commodorites. All the same, I do agree that this is an example of bad programme building.

* * *

The chief interest of "Dr. Faustus" was that it was given by the O.U.D.S. It's good to hear an outside society sometimes. I wish the invitation to broadcast from their own theatres was extended to a number of societies of repute.

What a stimulus this would be to the amateur actor! Aren't there something like 8,000 amateur dramatic societies in Great Britain? These alone would guarantee an audience big enough to justify giving a broadcast, say, of the best amateur production of the year.

* * *

I didn't listen to the whole of "Dr. Faustus." The dialogue was too lacking in light and shade. It became very monotonous after a time; it was all too serious in tone. Besides, R. F. Felton, who played the title part, would drop his voice at the end of each phrase. Listening became a strain. **C. B.**

THE LINK BETWEEN

(*Continued from page* 172.)

occurs to me that my short-wave friends may be interested to know that this same firm is also manufacturing, under exclusive licence, the original Brown's phones. Incidentally, these phones, I understand, are being used extensively in the equipment of the new police "Q" cars.

The address of the National Radio Service Company is 15–16, Alfred Place, Tottenham Court Road, London, W.C.1.

Metal Rectifiers for Radio Frequencies.

Those of you who have not yet familiarised yourselves with the numerous interesting applications of the new Westinghouse radio-frequency metal rectifier would be well advised to obtain their instructional leaflet DP11WX, without delay.

I have just been reading the leaflet myself, and it would appear that the scope of this new Westinghouse production is almost unlimited. The use of these new rectifiers for

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way — just quote the number or numbers.

detection in superheterodyne sets, automatic volume control, automatic volume control from existing detectors, battery economy, etc. (all of which are dealt with in the leaflet), are applications which I am certain are not appreciated by many constructors, and because I am convinced that there is likely to be a great

(*Continued on next page.*)

THE LINK BETWEEN

(Continued from previous page.)

extension in the use of these rectifiers in the near future, I am going to make the leaflet available through the medium of our postcard literature service. Just let me have a postcard in the usual way, and I shall be pleased to do the rest. **(No. 84)**

NEXT WEDNESDAY

Details of

TWO COMPLETE TELEVIEWERS

for home constructors will be found in the

SPECIAL TELEVISION NUMBER OF POPULAR WIRELESS

INFRA-SONICS

(Continued from page 156.)

As the name implies, Infra-Sonics deals with very low-frequency vibrations, below the lower limit of audibility—vibrations which, in fact, may be felt but cannot be heard. As you have no doubt begun to guess, the new system comprises the addition of *feeling* to radio or gramophone reproduction.

But the feeling imparted by the direct hearing of an orchestra or band is built up of two things: overall loudness—that is, a relatively great amplitude of all the audio-frequencies—and families of beat frequencies, many of which are so low that they cannot be heard as musical notes at all, but can only be experienced as sensations of feeling. By this I mean vibrations of the order of 10 even down to 5 cycles per second.

"The Effect Is Amazing."

When these exist alone there are no sounds to be heard, but you experience a series of compressions of the air, upon your body in general and your ears in particular, although not necessarily with uncomfortable intensity.

The Infra-Sonic system electrically injects these inaudible frequencies into the reproduction, and therefore you get all the feeling effects without the ordinary impression of loudness.

But I don't want you to run away with the idea that Infra-Sonic frequencies are just thrown in indiscriminately as a foundation or background. If that were done the result would, of course, have little artistic value or none at all.

On the contrary, this Infra-Sonic foundation is blended with the music at each and every moment, and follows faithfully every inflection of broadcast reception.

The effect is amazing.

Let me tell you just one incident which occurred during some of the tests. One of the staff photographers, who, like all other members of the "P.W." staff, is accustomed to hearing radio sets at all hours of the day, happened to be passing by the laboratory whilst the Infra-Sonic set was in operation.

I should explain that the famous Guildhall School of Music is adjacent to the "P.W." laboratory, just a few yards across a rather narrow street. The staff man looked into the room, not at the Infra-Sonic set (he didn't know anything about it), but through an open window and towards the Guildhall School. When asked what he thought of it, it dawned on him what it was, and he exclaimed: "Upon my soul, I thought it was an orchestra over the way!" **I can only ask, in present-day parlance, "What d'you know about that?"**

Well, now I think I have said enough for the present, and in a further article next week I will let you into the details of how it is done. I would just like to whet your appetite, before leaving you, by mentioning that the Infra-Sonic vibrations are quite artificial and are generated independently of the receiving circuits of the radio set.

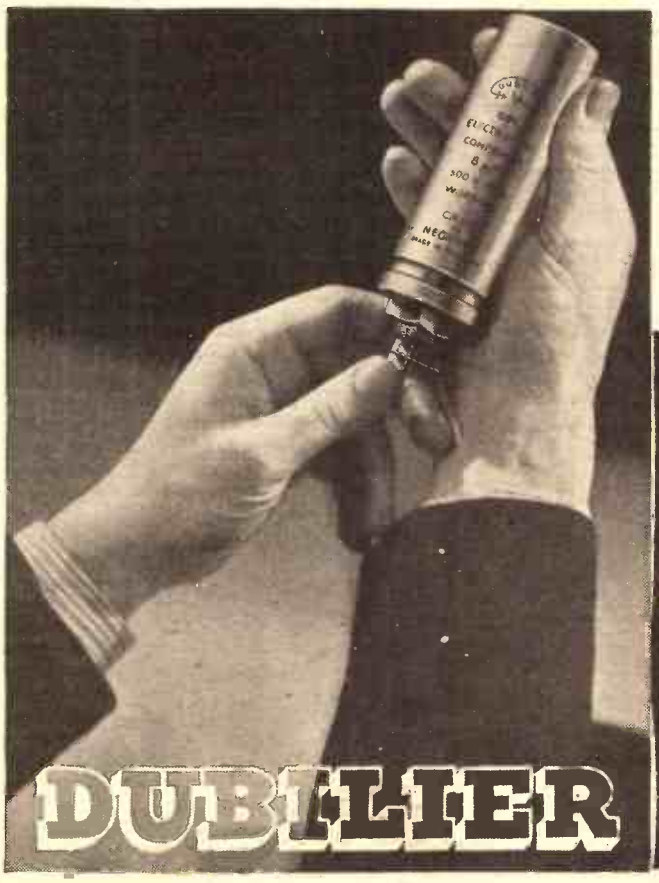
Exact Balance And Proportion.

But they are rigidly tied to the output of the set and automatically and exactly follow the variations of the output, every single fluctuation of loudness from the set carrying with it an exactly balanced proportion of Infra-Sonic energy!

And I must whet your appetite still further by telling you that, in my opinion this new discovery may well revolutionise the sound reproduction of the Talkies.

[In my next week's article, "Real Life Reproduction" I shall be able to disclose some of the secrets of Infra-Sonic technique.

Renowned for Reliability and long Service . . .



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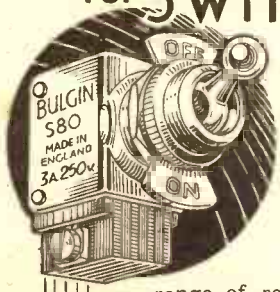

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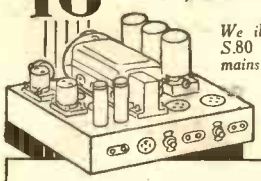

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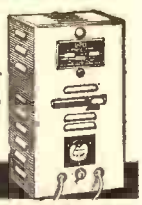

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PARALLEL-FEED AMPLIFICATION

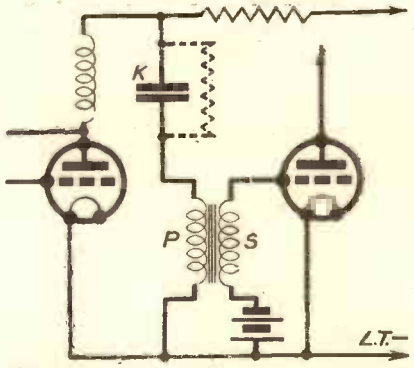
Some pointers on a popular method of L.F. coupling.

THE term "parallel-feed," or "shunt-feed," is applied to methods of coupling L.F. transformers which often seem very different in various circuits.

The simplest arrangement is shown in the diagram. It reduces essentially to a combination of transformer and resistance coupling, whereby the steady anode current is diverted from the primary by a fixed condenser K.

It is well known that this is practically essential with transformers of the "nickel-alloy" variety, for a small polarising current through the primary may spoil the whole performance by lowering the inductance to something less than an ordinary transformer.

A SIMPLE SCHEME



This circuit shows the usual arrangement for a parallel-feed transformer-coupled L.F. stage. The dotted resistance, if used, can have a value of 1-2 megohms.

But it has been shown that a very minute magnetising current may sometimes be a real advantage in raising the permeability and inductance somewhat and enabling the core to be worked at a more favourable point in its B-H Curve. To bring this about it is sufficient to shunt a 1- or 2-megohm leak across the condenser K.

The other "parallel-feed" connections referred to are properly *auto*-couplings. That is, the transformer ceases to be of the ordinary type with separate primary and secondary windings. The usual coil may still act as primary, but it is connected in series with the secondary to give one large coil made up of both windings.

In this way the voltage "step-up" is increased or decreased according to whether the windings are coupled to act *together* or in *opposition*.

The principal advantage of the method is that it enables several ratios to be obtained off a transformer of fixed "turns ratio" by suitably modifying the connections. **H. R.**

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Amplification Ratio.

AMPLIFICATION factor is a term which often puzzles beginners in radio. It is the quantity which is generally denoted by the word "mu." Strictly speaking, it is more correct to refer to the amplification *ratio* rather than the amplification *factor*.

It can be explained in this way: If the grid bias is increased, the anode current, for a given anode voltage, will diminish. If the grid bias is increased or decreased by 1 volt, then the number of volts which must be added to, or taken from, the anode voltage, in order to keep the anode current constant, is called the amplification ratio.

It is thus the ratio of the change of volts on the anode (which must be made to "counteract," as it were, a small change of voltage on the grid and so keep the anode current constant) to the grid-volts change. If 3-volts change on the grid necessitated 30-volts change on the anode to keep the anode current constant the ratio would be 30/3 or 10.

Mutual Conductance.

It is convenient, whilst on this point, to define "mutual conductance," which is another term that often causes misgivings. In the above-mentioned examples we have supposed a change to be made in the grid voltage, and we have discussed how the effect of this can be counteracted and the anode current kept constant.

The "Slope" of the Valve.

Suppose, however, that, instead of readjusting the anode voltage, we leave it alone and see what new value the anode current will take up (for the *same* anode voltage) in consequence of the change in the grid voltage. Then the change in the anode current per volt of change in the grid voltage —or, if you like, the change in anode current divided by the change in grid volts —is called the "slope" of the valve. If the anode current changes, say, 3 m.a. for a change of 1 volt in the grid voltage, then the "slope" of the valve is said to be 3 m.a. per volt, or, as it is written, 3 m.a/v.

The "slope" of the valve is a very important characteristic, for upon it depends the "goodness" of the valve from certain points of view. However, I haven't the space to go into that question just now, but will refer to it again another time.

(*Continued on next page.*)

INCREASE THE SELECTIVITY OF YOUR SET!

OVER 1,500,000 LISTENERS USE A——

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to separate those stations that overlap each other. Get rid of that annoying muzziness that spoils local reception. Just **FIX A PIX** in your aerial lead. You will be surprised how sharply your set tunes, and delighted at the number of new stations you can hear clearly. Try one to-day. Send us 2/-. If you are not completely satisfied, return it to us within 7 days for full refund.

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P/X

TECHNICAL NOTES

(Continued from previous page.)

Output Valves in Parallel and Push-Pull.

I have many times been asked the difference between two output valves in parallel and the push-pull arrangement—I don't mean the difference in actual arrangement so much as the difference in performance—and under what conditions the one or the other is most suitable.

Perhaps the simplest way is to explain at once that with the push-pull arrangement the grid swing is doubled, so that you can use a much larger input, but the mutual conductance is not increased, and the impedance is doubled. With the parallel arrangement, on the other hand, the grid swing is the same, but the mutual conductance is doubled—in theory, at any rate—and also the impedance is halved.

Thus you see that if overloading is your trouble, the push-pull should be your choice of these two; on the other hand, the parallel arrangement, for a given signal, will give you a larger undistorted output.

Experimenting with the Alpha Rays.

A very interesting experiment was made recently by Lord Rutherford in a public lecture in connection with the latest theories as to the structure of the atom. In this particular experiment a very small alpha-ray tube was used with an aluminium cap, and it was shown that, owing to the bombardment of the aluminium by the alpha particles, the aluminium became temporarily radio-active. The alpha rays were then prevented from reaching the aluminium, and it was found, after about five minutes, that the aluminium had lost its radio-activity.

Comparable with the Cosmic Rays.

In this experiment very delicate indicating means had to be used, and the effect which was to be demonstrated was so small that it was comparable with the effect of the cosmic rays. The cosmic rays, as you know, pass through the roof and walls of a building—in fact, through practically everything—and these, as were shown in the experiment, produced a radio-activity which was represented by 42 impacts per minute on a sensitive screen. After bombardment the aluminium gave 163 impacts, the difference of 121 per minute being due to the temporary radio-activity produced in the aluminium by the bombardment by alpha particles.

The Atomic Structure.

During the course of this lecture Lord Rutherford stated that, "although we have a general knowledge of the mode of transformation of radio-active bodies, it is very unlikely, when we consider the complexity of the nucleus system, that we can hope to gain any very detailed knowledge—at any rate, for a very long time." "The nucleus, excessively minute as it is," he said, "controls the whole atom, both its chemical and its physical properties."

Short-Wave Reception.

In view of the great and increasing interest in short-wave reception it is important that those of you who are thinking of going in for short-wave listening, whilst understanding the attractions and fascination of short-wave work on the one hand should, at the same time, realise that it has certain limitations. I mention this so that you will not expect too much.

Listening on short waves involves many factors which make it quite different from listening on the broadcast waveband. For one thing, reception distances are generally much greater. In fact, distance is almost essential to the short-wave listener, and he seems to enjoy most what he hears from the greatest distance.

This, however, means that the intervening medium plays a very important part in short-wave reception, and over great distances it is in the majority of cases only the "sky wave" which we receive. In its long journey by this path it is subjected to all the vagaries of the upper regions of the atmosphere. The variable features of the medium, through which short waves are generally received, account for the variations in reception in this band.

Periodic Variations.

For one thing, you will find that, if you listen on one particular frequency in the short-wave region, reception will vary from hour to hour during the day, and you will find that there is a "best time" of day for listening, and, of course, you will also notice that there are seasonal changes as well as day-and-night differences. At night the stations which become difficult to hear are those above about 10,000 kilocycles, whilst stations much below that frequency may come in quite well.

During the early part of the day, when both the transmitting station and the receiving set are probably in a region of daylight, stations above 15,000 kilocycles come through best, whilst in the afternoon, when the listener is in a region of full daylight, whilst the transmitter may perhaps be still in darkness, stations between 8,000 and 15,000 kilocycles are often best received.

The Question of Fading.

Another practical point is that, if you are receiving over long distances, the time of day at the transmitter will probably be very different from the time of day with you, and therefore, at a time in the evening which is convenient to you, you must not always expect to hear the sort of things appropriate to that hour, because with the other fellow it may be day or, on the other hand, it may be in the small hours of the morning.

(Continued on next page.)

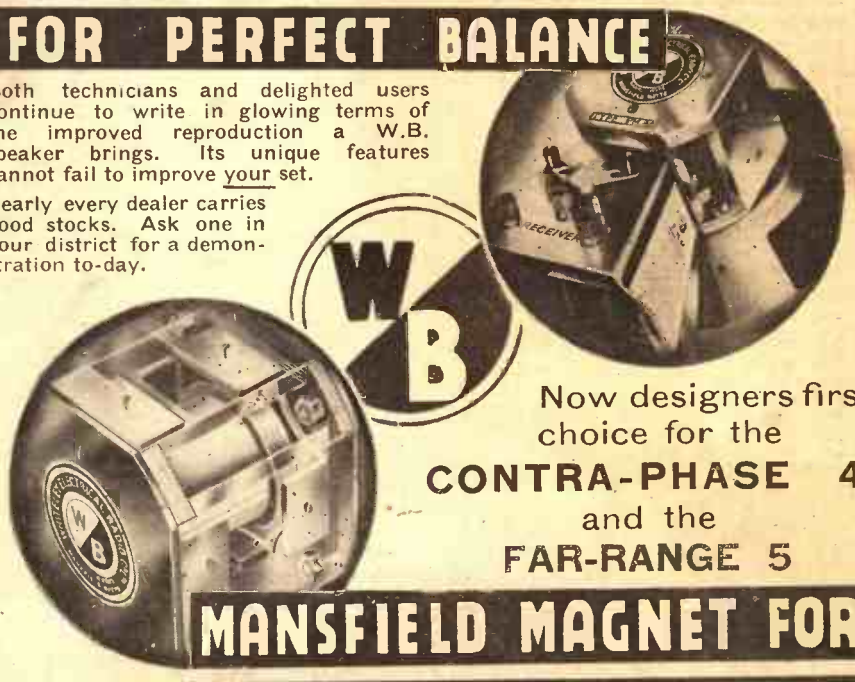
A REAL MIDGET

This is one of the new midget valves which are available in the Marconi and Osram ranges. It will be seen that the base is of the pinless type.

MICROLODE MATCHING
FOR PERFECT BALANCE

Both technicians and delighted users continue to write in glowing terms of the improved reproduction a W.B. speaker brings. Its unique features cannot fail to improve your set.

Nearly every dealer carries good stocks. Ask one in your district for a demonstration to-day.



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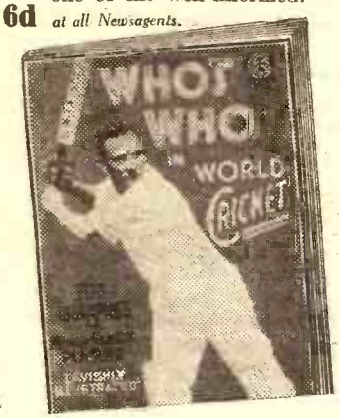

TECHNICAL NOTES

(Continued from previous page.)

Fading on short waves is often quite different from what you get on broadcast wavelengths. With short waves the fading period is apt to be longer, the changes in volume being more gradual, so that a signal will swing entirely out and remain out for some time, just as if there were no station on the air at all. Gradually the signal will return and remain strong for a few minutes, or even as much as an hour. Accordingly, if you are hunting for a station which you know to be on the air, you have to be patient and give it a chance to swing in again, in case it happens for the time to have faded completely out.

Adjusting Multi-mu Valves.

Many people who use multi-mu valves do not seem to get the best out of them. As you know, if you increase the negative grid bias of this valve its response to an unwanted signal close to the desired signal will be reduced. Suppose, for instance, that you want to separate two powerful stations on very closely adjacent wavelengths. The volume control should be set to about half-way and reaction should be turned very low; with this arrangement tune in the station you want. You are practically certain to have plenty of interference from the other station.

Now turn back the volume control, which will have the effect of increasing the negative grid bias until the interfering station disappears. It is probable that in the process you will have reduced the wanted station almost to zero. Now you turn to the reaction control and increase the reaction so as to bring up the strength of the wanted station, at the same time turning the volume control, if necessary, still lower. In this way you will probably be able to get in the station you want without interference from the other one. It is surprising, by juggling about with the reaction control and the volume control, when using multi-mu valves, what selectivity you can obtain.

Unsatisfactory Reaction Control.

Talking about reaction generally, by the way (quite apart from any question of multi-mu valves or any other type of circuit), I have often thought that many commercial sets have very unsatisfactory reaction control fitted. In some of them, just when you are nicely bringing up the strength of a signal, the set will jump into oscillation. This applies especially to mains sets, many of which have very "fierce" reaction control. Reaction should be smooth, and there should be little, if any, overlap.

I don't know why manufacturers (or some of them) do not pay more attention to this point, because it makes an enormous difference to the satisfaction which the user gets out of his set. It isn't as though the manufacturers should have any great difficulty in providing nice, smooth-working reaction control, any way.

Earthing and Stability.

As a general rule it is advisable to earth the metal case of any transformer or choke or such-like component; often an earthing terminal is provided if it is intended that it should be earthed. In some cases the component will be automatically earthed when it is screwed down to a metal chassis or a baseboard which is metallised on the surface. This is generally advised, because the earthing cover helps to cut down interaction and generally assists in stabilising the set.

Take Care with Mains Components.

But when there are mains connections knocking about you want to be careful about earthing, as it may be dangerous. If you have any doubt about it, or if, in fact, you are instructed that the component—say a mains transformer—should *not* be earthed, then you must, of course, take care not to screw it down on to a metal chassis or metal-covered baseboard. The proper thing to do is to place a sheet of insulating material under the transformer and to make certain that the holding-down screws do not touch the metal chassis or the metal of the baseboard.

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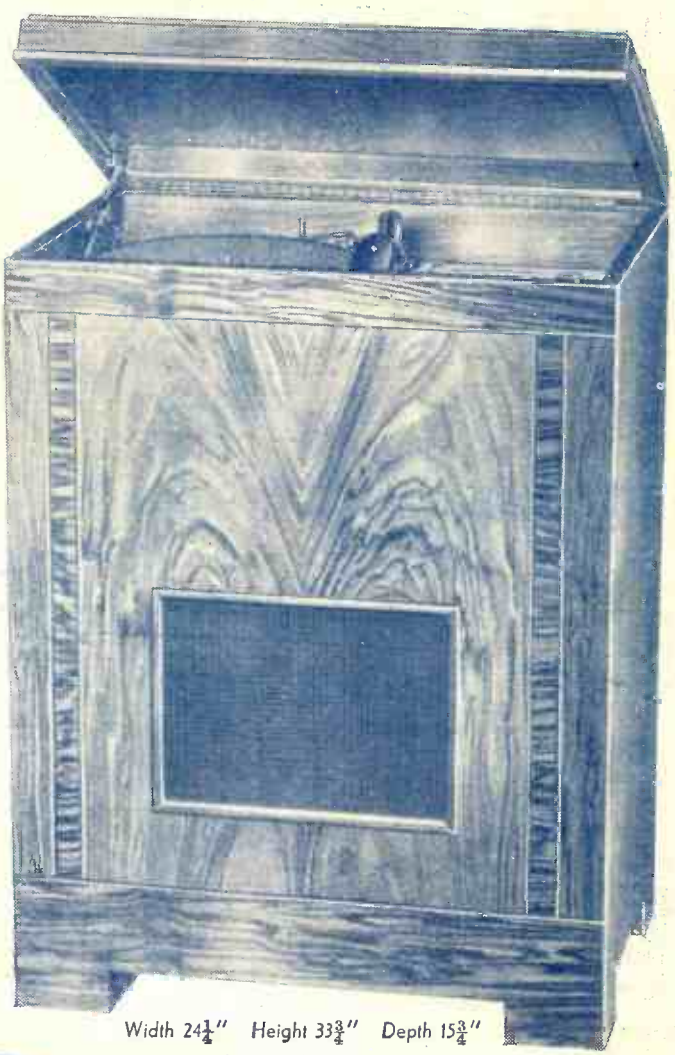

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